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MODEL AIRPLANE NEWS

THE WORLD'S PRE

Byron Originals BD-5J JET

Sig's New-Generation CITABRIA

Build the Vintage-Pattern CRUSADER

AEROBATIC SPECIAL

Goldberg's New SUPER CHIPMUNK

Tangerine TOP GUN

1988 U.S. Aerobatic Team

Plenty of R/C Modeling Tips

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JUNE 1988 VOLUME 116, NUMBER 6

MODEL AIRPLANE NEWS

ON THE COVER: The new CGM Super Chipmunk appears to be strafing Norm Holland's Byron Originals BD-5J, which duplicates the full-scale Coors Silver Bullets flown by Bob Bishop and Dave Hoover. Tangerine Top Gun Ron Gilman flew his Aggressor in the new Jet Pattern event while MacDouglas' ultimate aerobat, the F-15, keeps a watchful eye on a taxiing Pitts S-1T.

FEATURES

COLUMNS

CONSTRUCTION

COLUMNS

DEPARTMENTS

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Editorial

by RICH URAVITCH

WELCOME TO THE MULTI-FACETED world of aerobatics. This always-exciting element of aviation is perceived by airplane people in about as many different ways as there are different types of aerobatic airplanes, both model and full-scale. Some see it as the ultimate in man-machine synergism, where the pilot and his airplane are truly interactive, functioning as one. Carnival barkers hawk it as barnstorming, derring-do; death-defying "stunts" performed for thrill-seekers' entertainment. No doubt about it, it takes above-average pilots to withstand the grunt-inducing, eyeball-popping, torso-compacting, muscle-straining rigors of aerobatic flight... and that's not just with us modelers!! Another view says that aerobatic flight represents the most fluid choreographed motion... "aerial ballet" is frequently heard. Whatever your perspective, modelers have always been fascinated by it. If not, why do we do our loops, rolls, spins, inverted flight and even "slipped" landings. Let's face it, if we weren't taken by it, we'd never venture beyond taking off, staying in the pattern and landing. So now that we've admitted it, let's explore it a bit.

This issue tells you how the "Big" guys and gals of the 1988 U.S. Aerobatic Team do what they do so well. Mike Lee flies you through a primer on IMAC flying technique, we review four kits that can certainly get you involved in aerobatics, and we repeat a presentation of one of our most popular scratch-built designs for all you balsa-choppers who want to build a great performing airplane that will grow with you in your quest for aerobatic excellence. It's Ralph Brooke's Crusader, which was originally presented in *MAN* over 20 years ago. Pappy deBolt's "Old-Time R/C" article in the April issue elicited a lot of responses from modelers who expressed interest in early pattern designs. The "vintage aerobatic" movement seems to be thriving in England; seems like it could experience a revival here in the colonies. We hope you'll enjoy it; we enjoyed putting it together for you.

• Don't forget our "Reader Reports," two of which appear in this issue. These give *you* the opportunity to sound off on what you thought about that kit you recently built. Full details for participation are in the January issue, and a list of the Field and Bench kit reviews we currently have underway, appeared here last month.

Coming up in the August issue... rotary-wing rampage!!

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Airwaves

Outta Site!!

My modeling began back in the early '40s, when flying sites were everywhere! All you had to do was walk across the street to the school, and you could fly, or bicycle out to the fields at the edge of town, if free-flight was your thing. Well, now we have radio-control planes within the reach ($) of everyone, but fewer and fewer places to fly them. Even school grounds are out unless you carry $1 million insurance!

At the hobby shop yesterday, we were lamenting the lack of sites. The manufacturers and hobby dealers are doing a great business. The sport (it's no hobby anymore; so many don't build, they just buy and fly) has grown by leaps and bounds, *but nothing* has been done about sites!

If the modeling industry wants to keep this gold mine going, it should be an association of all the manufacturers, distributors *and* hobby-shop owners that seek out these sites—*not just model clubs!* If the people who sell the stuff don't help provide places to fly, we builders will just have to quit, and there go *all* the profits...!

How about it, modeling industry representatives?

Ron Fikes
Palo Alto, CA

Ron, your point is well taken and may represent a resource previously overlooked. In recent years, the industry in general has grown rapidly, as has the number of modelers involved in R/C. The number of flying sites, however, seems to be shrinking even more rapidly! It would seem that we all, modelers and industry alike, have strongly vested interests in preserving what remains. How about it, industry reps??
RAU

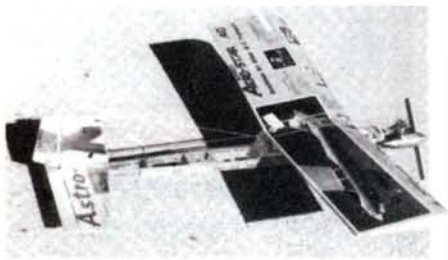
More Small-Plane Fans

My son and I, only two years into the hobby, look forward to the next issue.

The April issue was particularly good, as we want to build a 1/2A-size plane for many of the reasons you mentioned in your editorial. You mentioned that there is a vast array of smaller models available. Unfortunately, our hobby shop features the larger planes. There was a very nice construction article on the "G-Man" plane in the April issue, and we'd love to build it. Unfortunately, I have *no* information about the G-Mark .061 R/C engine and neither does our hobby shop. The only manufacturer acknowledged at the end of the article is Cox Hobbies, which I presume is for the Cox TD .049-.051 engine also mentioned in the article.

Pete Kilen
Esko, MN

Thanks Pete, we're glad you and your son enjoy MAN. *In response to numerous letters like yours, the G-Mark .061 is available from Cannon R/C Systems, 2828 Cochran St., Simi Valley, CA 93065. The new Cox Queen Bee R/C .074 is a similar size engine which should be very well received by the small-plane crowd.*
RAU



Zero-Waste R/C

I read your "Giant Steps" article in the April '87 issue of *MAN*. I had just completed my "Yard Stik .4T" (original). After reading the caption at the top of your article, I thought I'd send you a couple of the pictures. It should be obvious that I used kit boxes for the construction.

The Yard Stik has a wingspan of 46 inches and a chord of 12 inches. It weighs 5 pounds, 3 ounces and is powered with an HB .40 PDP. Flight-tests are awaiting my recovery from a knee operation.

(Continued on page 10)

Airwaves

(Continued from page 8)

I really enjoy your articles and always look forward to them.

Dick Barbosa
Pottsboro, TX

Dick's Yard Stik is truly a "waste not, want not" project. For you other readers, the caption he refers to said, "Soon you'll be able to use the box the kit came in." We really didn't think anyone would take it literally, but it's a unique and clever idea. Residents of Pottsboro, even your trash cans aren't safe from the Flying Barbosa!!
RAU

Club Decal Exchange

For those interested in exchanging decals: Please send us five to ten of your decals, and, in return, we'll send the same number to you.

SAM-ITALIA, c/o Ivan Poloni, V.le Abruzzi 14, 24035-CURNO-BG, Italy.

ARF Support

Here are some comments about Jim Waterman's letter, which appeared in the April '88 issue of *MAN*. Mr. Waterman is known for his work with R/C trainers. I respect his dedication to a project. I'm not very enthused by his limited perception of the value that ARFs can bring to aeromodeling. My qualifications to speak are 40 years of aeromodeling experience and owning a large hobby shop for six years.

People live in places that don't provide them with a large workshop where they can chip balsa, sand balsa, drop paint and epoxy, spill alcohol and castor oil, and dump piles of broken airplanes. The ARF can fill a need by allowing these persons to enjoy model aviation within their limitations and objectives. ARFs are a way to entice would-be modelers into the activity. People who work long hours have little inclination to glue balsa, yet they can enjoy steering that remote-control toy around the sky. So, for the future of model aviation, I'm thankful for ARFs.

ARFs may well be the tool to ensure a larger number of modeling friends around the country. ARFs are a boost to the industry economically. It's a problem when older, experienced modelers allow their personal prejudices and narrow perceptions to limit their appreciation of new opportunities that increase the interest in this wonderful world of model aviation. Jim, wake up!

Horrace Cain
Humble, TX

Mr. Cain is former AMA V.P., and his letter captures the essence of virtually all the mail we received on this subject. Some of the responses were amusing and entertaining; others, decidedly unprintable, but all were informative. While we applaud the activity of Mr. Waterman, which represents his *way of nurturing the newcomer, we still feel that some ARFs can do everything his approach does, without making substantial demands on one of our most limited resources*—Time!
RAU

In Search of the Buckeye

In your "Airwaves" column (March '88 issue of *MAN*), you published a request from Mr. Lewellyn for a source of a Berkeley Plan Set for the North American T2J-1 Navy Jet Trainer.

This is available from John Pond, Old-Time Plan Service, 253 North 4th Street, P.O. Box 90310, San Jose, CA 95109. (408) 292-3383; (408) 225-0308 (after 7 p.m.)

It is listed in their Flying Scale Plans List No. 15 (1985) (A-K and L-Z) as follows:

Plan No.: 51D2; Name: North American T2J-1; Mfg./Designer: Berkeley; Size: 23 FF; Price: $3.

I always buy your magazine. Glad to be of some help.

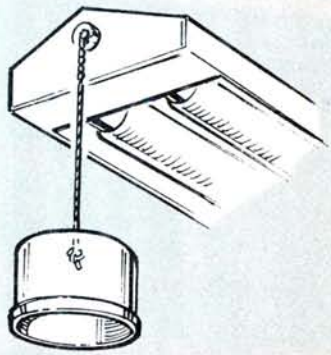
John I. Henderson
Ontario, Canada

John, thank you for helping a fellow modeler. Once again, a great example of the camaraderie that is so typical of our hobby.
RAU

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.

Hints & Kinks

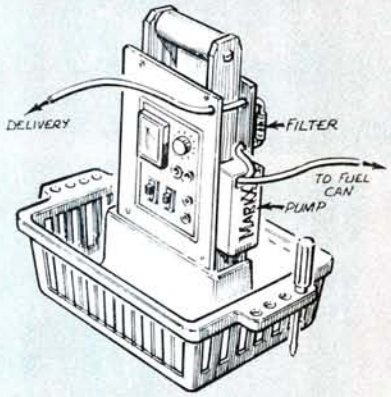
by JIM NEWMAN



PULL-CORD MARKER

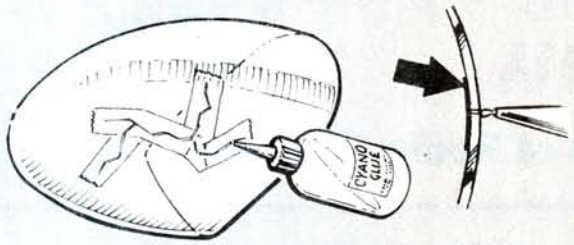
Ever tried to find the light-fixture pull-cord in the darkness of your shop? Take the white cap from an aerosol can, drill the top, pass the cord through the hole and secure it with a knot. Our contributor says the shiny white plastic is easy to find in the gloom. My phone company gives out luminous stickers with emergency phone numbers. Why not attach a couple to make the pull really visible?

Harry Braunlich, Victor, NY



DIME-STORE CADDY

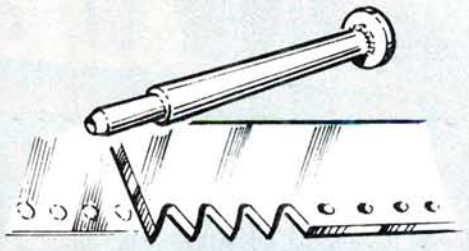
This plastic caddy has some simple additions that carry a power panel, fuel pump, filter, tools, fuel can, etc. The vertical divider is made of Masonite scraps, dowel handle and wood strip; spare propellers are clipped onto the side opposite the power panel. The electric starter, 12V cell, tools, fuel, etc., fit in the basket. Just keep fuel on the side opposite the battery! *Dan Moser, Post Falls, ID*



CANOPY REPAIR

This cracked canopy was easily salvaged after a prang. Cracks were squeezed shut, vinyl tape applied on the inside, then CA glue wicked in from the outside. When set, the tape was removed, the canopy sanded with No. 600 sandpaper and lots of soapy water, and then polished with metal polish. The repair was almost invisible.

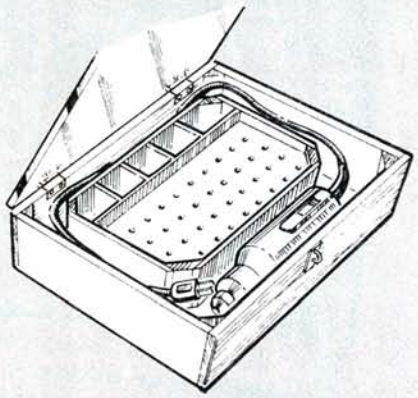
David Davidson, Euless, TX



SCALE RIVETS

Here's how to simulate rows of equally spaced rivets. The rivet tool is just a suitably sized brass tube, sharpened and soldered into a tube handle that has a brass disk at the top. The disk allows pressure to be applied while the tool is twirled. The spacing gauge is a strip of metal or plastic with equally spaced holes which are filed out to a V-shape. (I wonder why they need to be "veed"; a simple hole will keep the tool centered.) Anyway, judging by the sample sent, it works well and makes various sizes.

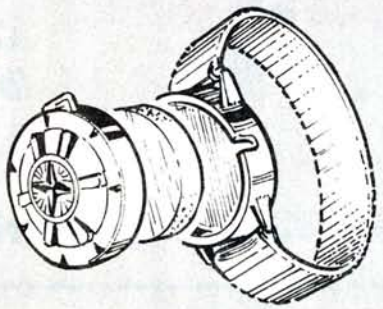
Jim McCurrach, N. Vancouver, BC, Canada



DREMEL STOWAGE

For the tidy-minded, this is a really nice shop accessory; it even has a Plexiglas lid! Sanding drums, spare cut-off disks, collets, etc., go in the small compartments. All the burrs and grinders go in the many ⅛-inch holes. The Moto Tool goes in the large compartment, while the AC cord lies in the perimeter trough. The materials are wood, ply or Masonite with a plastic or ply hinged top.

Charles Batt, Dieppe, NB, Canada



WRIST FUEL GAUGE

Some of us wear an Ace R/C Memo Timer that buzzes when we're short of fuel. This flier gutted an old wristwatch, glued in a block of balsa, then glued his Memo Timer to that. It's a neat idea, since it puts the timer where you can steal a quick glance at it while you're flying. I nearly break my neck seeing mine—it's on my lapel!

Julius Deltwas, Lawrence, MA

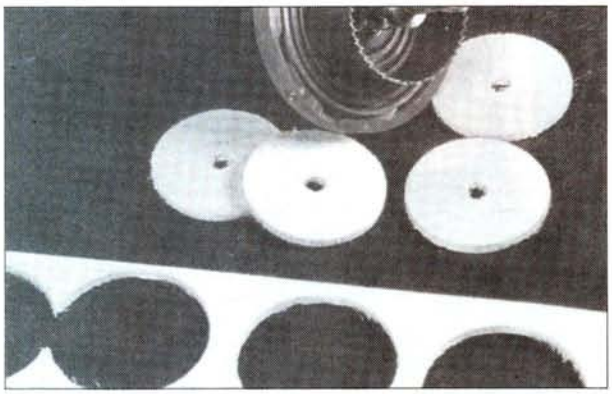
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News**, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

How To:

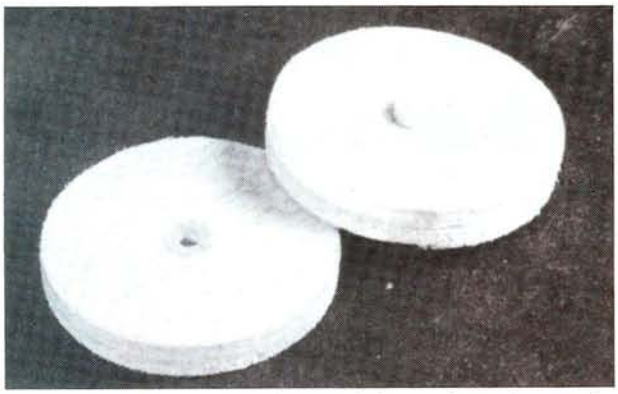
by RANDY RANDOLPH

MORE LIGHT WHEELS

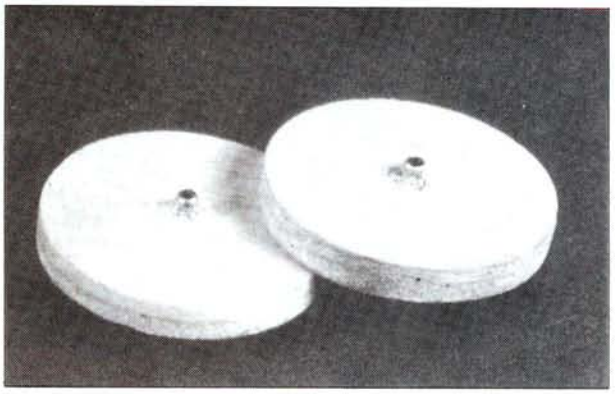
Most commercially available wheels are a little heavy for smaller airplanes. The photos show how to produce wheels in the 1¾- to 2½-inch range that weigh less than ¼ ounce each and stand up well on grass or paved strips.



1. The key to making these wheels is an inexpensive hole saw. Select the appropriate blade for the desired diameter (in this case, 2 inches), and saw four disks from 3/16-inch medium balsa sheet.

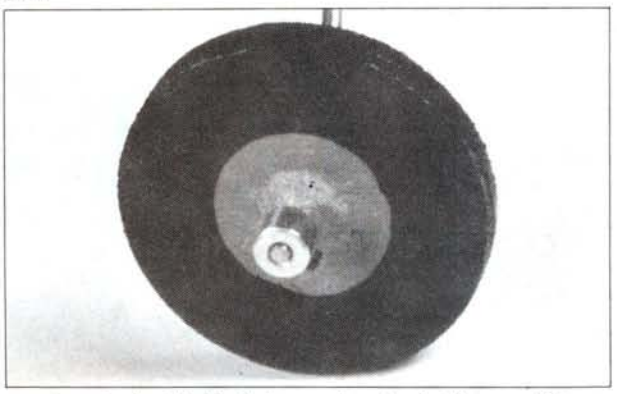


2. With the grain crosswise, glue two disks together to form each wheel. Glue ½-inch lengths of ¼-inch hardwood dowel into the center holes, sand flush with the wheels and drill a ⅛-inch hole in the center of each.



3. Center a ⅝-inch length of ⅛-inch brass tube in the center of each wheel, and glue it in place with instant glue. Build up gussets around the protruding tubes on all four sides with thick CA or epoxy.

4. With fuelproof paint, paint each wheel an appropriate color. Stretch a No. 73 rubber band, or a ⅜-inch-wide band cut from a bicycle inner tube, over each wheel, and glue it in place with instant glue.



5. Paint ½-inch-wide black tires on the wheels. It's a good idea to paint right over the rubber as well as the wood. The finished wheels are held on the axles with wheel collars.

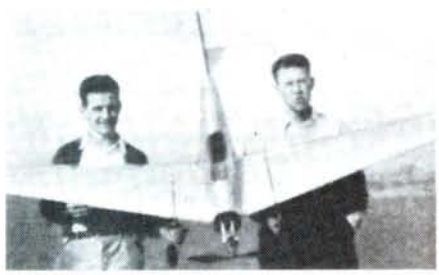
Fifty Years Ago...

by STEVE POND

IN JUNE 1938, *Model Airplane News* gave readers a second chance to enter the National Essay Contest, which it co-sponsored with MGM Studios. As well as the first and second prizes of round-trip Hollywood vacations, which we told you about in the last issue, there was a magnificent third prize.

Third prize was a custom-built "radio machine" from the then internationally known Pilot Radio Corporation. The radio cost a healthy $250 to build, which is about the same as today's better 5- to 7-channel radios. This may not seem like too much of a setback to some of you, but back then, this would have bought about 150 to 300 model airplane kits, 20 to 50 gas engines, or 104 years of *Model Airplane News* at the cover price!

As always, *Model Airplane News* was keeping the modeling public informed on the latest news of both model and full-scale aviation. Not much had happened on the model aviation front as far as the quest for radio control was concerned, but models were following in the footsteps of their full-scale counterparts: They were beginning to show more streamlined fuselages, and more and more models were showing low-wing configurations, e.g., the Ryan ST, the Supermarine S.6B and the Seversky P-35, as well as a number of sport planes. Even engine manufacturers, such as Southern Model Engineers, were making multiple-cylinder model engines in an attempt to replicate the full-scale aircraft.



Low-wing airplanes were becoming more popular among modelers, as well as in full-scale aviation circles. These two show off their latest effort.

An attempt to make planes as light as possible was outlined in an article called "Have You Tried Microfilm?" by the now well-known Carl Goldberg!

An article by Carl Goldberg, the "father" of modeling, showed how to use Microfilm.

On the frontiers of full-scale aviation, the Hall Aluminum Torpedo Plane XPTBH-2 was the latest in combination-type aircraft (such as torpedo-bombers and fighter-bombers). The Hall XPTBH-2 was, however, the first aircraft to combine three types of military craft. The odd designation merely meant that this craft was a patrol-torpedo-bomber manufactured by the Hall Aluminum Aircraft Corporation of Bristol, PA. The XPTBH-2 was a high-wing, twin-engine seaplane powered by two Pratt & Whitney "Twin Wasp Senior" double-row radial engines, each with 860 horsepower. Landing gear was two huge, specially designed floats attached to the wing in a full cantilever pier mounted directly into the engine nacelles. In the nose there was a section for a forward gunner that was completely enclosed in a revolving machine-gun turret. However, during offensive maneuvers, the gunner had a sighting window directly below and to the front of his seat for the torpedo runs. The gunner would lie flat and sight the target through this window. When everything was ready, he would give the signal and the projectile would be released. The XPTBH-2 carried the awesome 1,000-pound Whitehead torpedo, which was mounted horizontally within the hull below the crew's quarters. Each of the three gunners (there were also two turrets facing the rear of the plane) were outfitted with electrically controlled Lewis machine guns capable of firing 1,200 rounds per minute.

Model Airplane News *sponsored an essay contest. The winners would go to Hollywood to see Clark Gable shooting "Test Pilot"!*

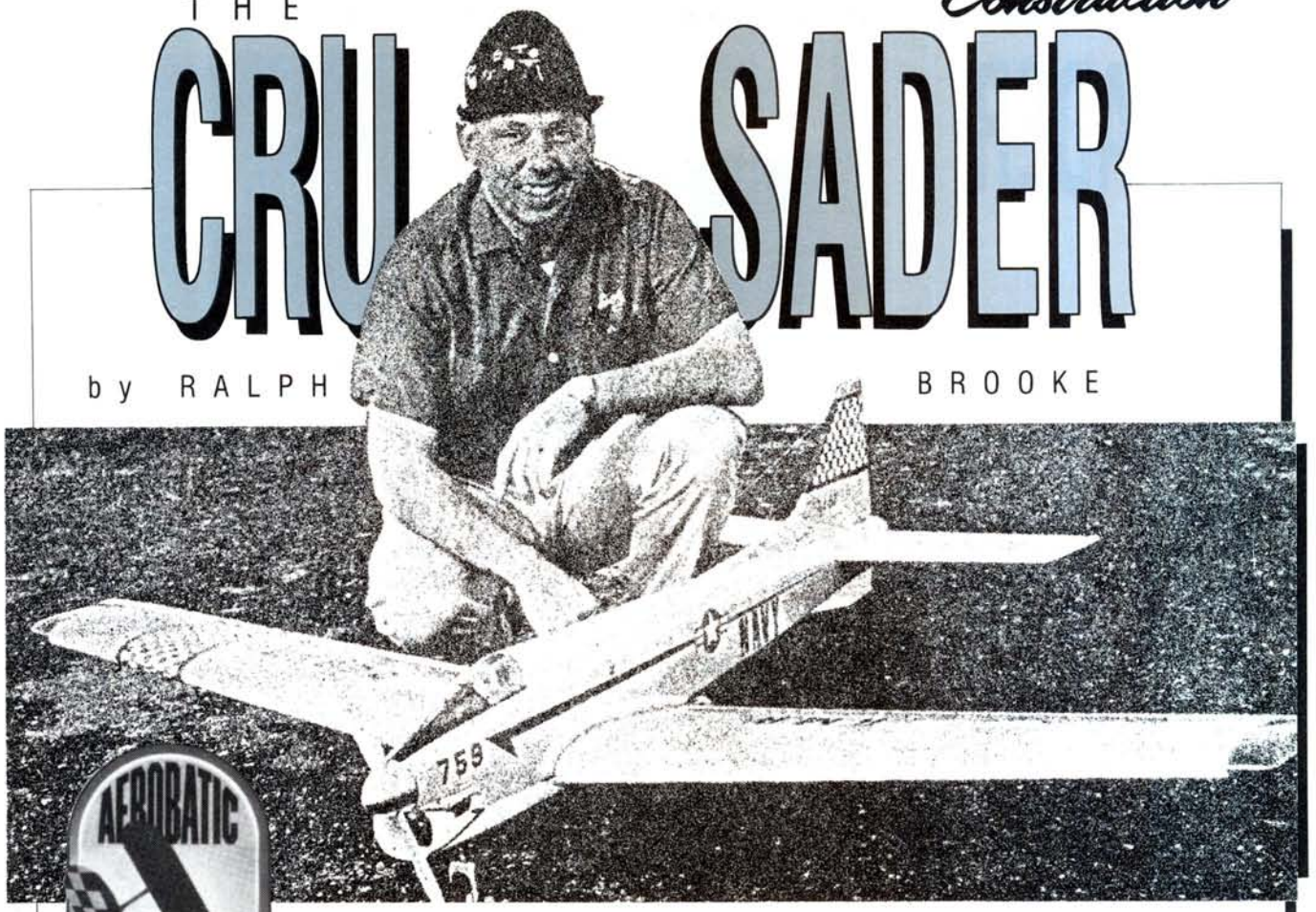
Other sea planes, like the 219mph Russian UT-1, the Fairchild A942-13, the Mayo Composite, the Grumman J2F-1 utility amphibian, the British supermarine "Walrus" amphibian and the 22-ton Potez were also "making waves" in full-scale aviation.

The world was in the process of conquering the skies with new and updated aircraft that were fast rendering their predecessors obsolete. For years to come, the aviation world was to experience growth at virtually breakneck speed, and *Model Airplane News* was there, Fifty Years Ago.

THE CRUSADER

Construction

by RALPH BROOKE



AEROBATIC SPECIAL

For many years pattern flight has been an intriguing facet of R/C modeling, and many designs, even though introduced years ago, can still be exciting today. The Crusader, first introduced in the pages of Model Airplane News *in February 1965, is one of these designs. This article is reprinted exactly as it appeared over two decades ago. Of course, you'll want to update the powerplant, radio, adhesives, and covering materials. As part of our Aerobatic Special Issue, we celebrate the legendary Crusader, a timeless classic.*

SPECIFICATIONS

Type: *Vintage Pattern*
Span: *68 inches*
Weight: *7 pounds, 2 ounces*
Area: *680 square inches*
Power Required: *.45-.60 2-channel; .60-.80 4-channel*
Features: *Built-up balsa construction; optional foam wing.*

MY MAIN OBJECTIVES in designing the Crusader were to have a plane with a unique appearance (preferably scale-like) and with improved flying characteristics. A model based on the Navy Crusader can be both very striking in appearance and highly maneuverable, and it will *never* be confused with current multi-designs.

Doc. Brooke never leaves anything to chance. Here, he's tuning his engine just before a Nats flight.

The first Crusader was designed and constructed during the winter and spring of 1964. It featured swept leading and trailing edges, weighed 6 pounds, 2 ounces, and was powered by a Lee .45. While I considered this a very successful model, there were some handling problems during windy conditions. This, plus my experiences at the World Championships in 1963, where wind was a definite factor in the contest, led

CRUSADER

me to redesign the plane.

The second Crusader, presented here, is heavier, at 7 pounds, 2 ounces; it has a longer tail moment; has only leading-edge sweep and is powered by a Fox .59. The reason for the change to the Fox .59 is its superior fuel-draw at high or low tank locations. Actually, I might have eliminated the tank cutout in the wing because of the good fuel-draw, but as everything was working so well, it was decided to leave well enough alone. This version flies well in calm and windy weather and took first place at the Canadian Nationals, and the Oklahoma City Invitational and third place at the Nats. With luck, it will accompany me to Sweden for the 1965 World Championships. The plane was designed for proportional equipment; it probably wouldn't be an outstanding "reed" plane.

(Editor's note: A phone call to Ralph elicited his reasons for his feeling that the Crusader would not be an outstanding reed plane, and we quote:

"...it combines realistic appearance with excellent aerobatic and ground handling."

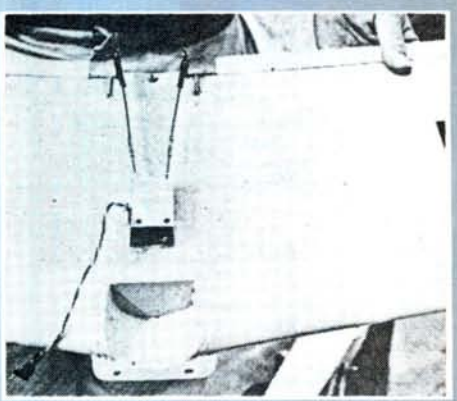
Front end of fuselage; Note bell-mouth inlet at front of cowl for good engine cooling.

"It's my belief that the reed servo response is not fast enough to take advantage of the full-span aileron. A typical proportional servo is twice as fast as a reed type and thus gives the right response for full-span ailerons.")

CONSTRUCTION:

The construction of this plane shouldn't pose any particularly difficult problems for the experienced builder, but there are some special techniques which I've found useful. Deviations from usual construction techniques are as follows:

- Use of a machine-built or Styrofoam wing.
- Removable tail assembly with internal control horns for ease of adjustment and packing.
- Use of dowel and Dzus fasteners for wing, and "Cam-Lock" for tail assembly.
- Use of ¼-inch aluminum engine-



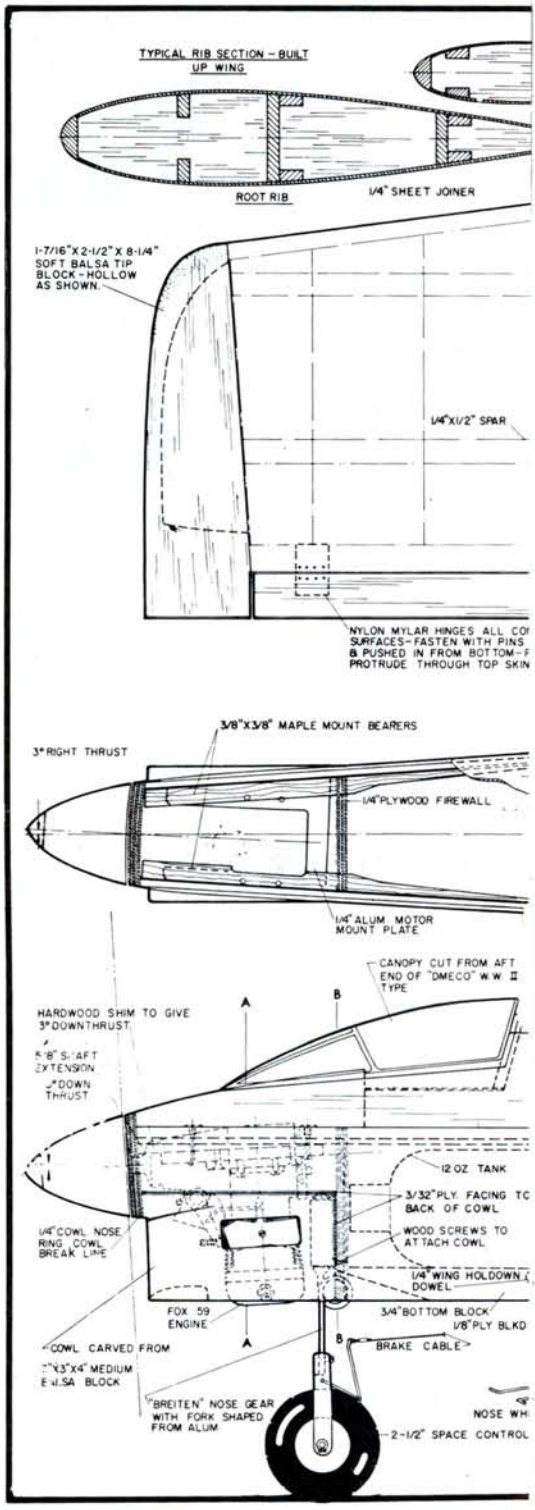
The wing topside. Cutout in leading edge is to allow clearance for fuel tank.

Inside the fuselage; S-shaped dingus at rear of fuselage well is Dzus fastener to attach wing.

ORDER THE FULL-SIZE PLAN

#186 CRUSADER $9.50

Dr. Ralph Brooke's classic design for Pattern competition was originally presented nearly a quarter-century ago. It represents an all-balsa project for the newcomer to aerobatics and a bit of nostalgia to stimulate the "Vintage Pattern" enthusiast. Either way, it shows that some designs are truly timeless. A 68-inch span with 680-square-inch area; scale-like appearance with proven performance. Two sheets.



mount plate to dampen vibration and increase power.

- Special cap for fuel tank to allow tubes to come out through the side.

For the wing, no construction data are given, since the original wing was machine-made and isn't commercially available. I suggest that you build a wing of Styrofoam using the rib

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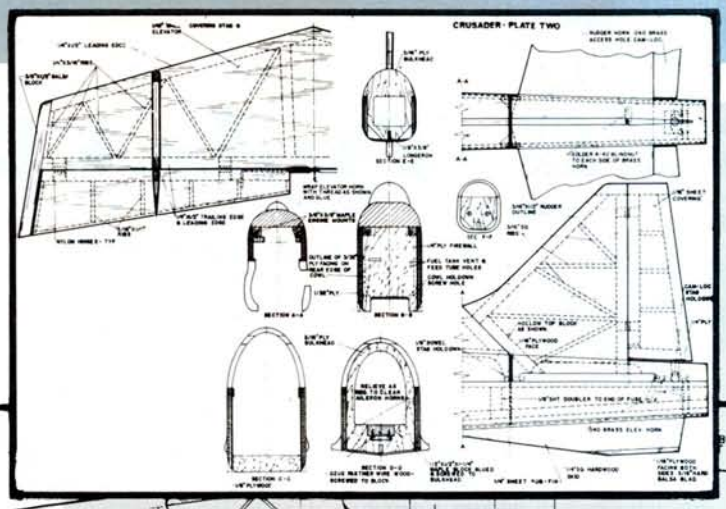
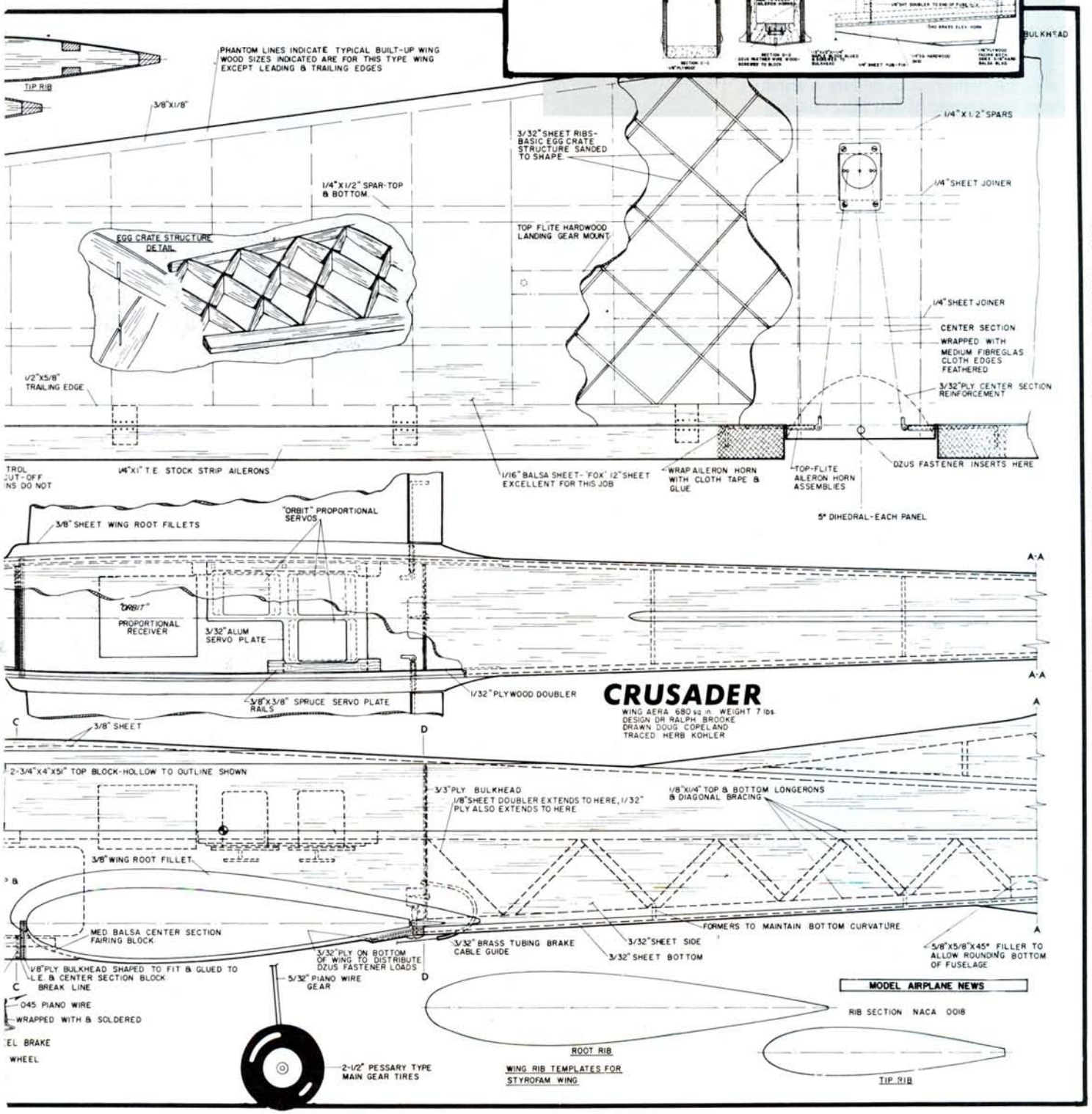


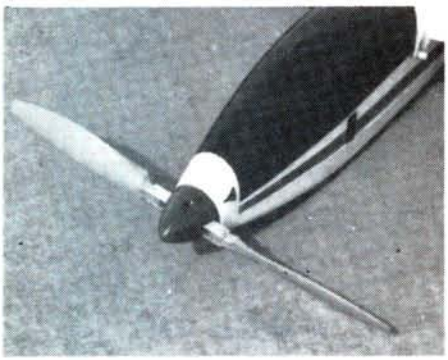


Quiet Flight

by JOHN LUPPERGER

THE FLYING SEASON is now upon us, and I hope that those of you who had to endure a harsh winter spent some of that time building. As for those of you who didn't, or who live in an area where flying goes on all year, I hope you've checked out your equipment recently. Those of us who fly all year tend to forget that we should take some time off and send our radios in for a tune-up. When was the last time you had your radio(s) checked by a qualified technician? You say you haven't crashed in the last couple of years, so why tune it? What about all those perfect and less-than-perfect (Don't worry, I'll have it ready for the next round) landings? You'd be surprised if you knew how out-of-tune most of our equipment is. Believe me, it's worth it to get your equipment tuned every couple of years.

And don't forget about all those other things that can deteriorate with age. Check all your linkages for bad solder joints on cables and nylon clevises or horns that may be ready to break. Hinges crack after a while and could give out at the worst possible time (like during a winch launch). Make sure your servo rails are still glued to the fuselage and that your servo arms have screws in them. If your model is a few seasons old, it may even be time to strip it and give it a new finish. Make 1988 a *safe* as well as enjoyable flying year!



EZ Elec 1800 comes with folding prop made up from Yoshioka blades with a lightweight aluminum channel hub.

The top five finishers at the Second Annual Harbor Soaring Society's HLG Contest. Left to right: 1st, Joe Wurts; 2nd, Mike Charles; 3rd, Mike Bame; 4th, Mike Reagan; and 5th, Jerry Bridgeman.

Electric ARF

Hobby Shack* is releasing a new electric ARF, and I was fortunate enough to be able to test the prototype. The Elec 1800 is an EZ ARF, and it comes complete with motor, gear drive, folding prop and spinner. The model spans 72 inches, uses the Eppler 207 airfoil, weighs 50 ounces RTF, and uses three channels on rudder, elevator and speed control.

The motor is a high-performance modular-ferrite-type commonly seen in off-road model cars. The gear-drive unit is similar to the type found in Kyosho's* electric models. It has a 2.4-1 ratio, and the brass gears are both held on with setscrews for easy replacement. The folding prop uses Yoshioka blades, and the hub is made of very lightweight aluminum channel.

I installed a Cirrus PCM 5 radio with a 250mAh battery, CS-33 micro-servos, a Panda MOSFET speed controller and a 900mAh flight pack. I was surprised at the climb rate, which is as good as I've experienced with built-up two-meter models using a geared seven-turn cobalt system. At a weight of 50 ounces, it was nice to see such a lively climb performance. The batteries were good for two climb-outs to about winch-launch height, and total run time was about a minute and a half.

Even though the model weighs 50 ounces, it flies like a much lighter aircraft. Because of its EZ construction, the fully sheeted wing is extremely efficient. Every launch resulted in a good thermal flight, with some flights lasting as long as 30 minutes. The model should appeal to the inexperienced electric flier, since it's very easy to build and relatively easy to fly. The more experienced modeler will find it very efficient and capable of giving contest-grade performance. The kit will sell for about $180 and should be available shortly after you read this.

HLGs—Contest or Class?

I've been flying hand-launch gliders for about six years. I was Contest Director (CD) for the first, second and third Inland Soaring Society's Annual HLG contests (this year will be their fifth), and I've heard a lot of differing opinions about size limitation. In the AMA rule book we

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have what is known as "Class A Hand-Launch Sailplanes." The rule book says: "Projected span limited to one-and-a-half meters or less. 'Hand-launch' only designates class and size. Models may be hand-launched or launched by equipment provided by contest director." It's clear to me that this is a designation of size (such as two-meter) and not a classification of contest type. The rule book implies that "Class A" can fly in any type of event, not just in a hand-launch contest.

I like the idea of combining the class with the type of contest. In other words, an HLG contest should limit the models to the size restrictions of "Class A." However, I also feel that the CD and the organizers of an event should have the right to allow any size of glider if they want to forget about the size restriction.

The Inland Soaring Society will be holding its fifth Annual HLG contest on June 5, in Riverside, CA, at the University Middle School. This is the premier HLG event, and it does have a size restriction of 60 inches projected span. It's probably the biggest HLG contest and attracts over 40 fliers every year. All rounds are flown within a ten-minute working slot, with all scoring done man-on-man. Round one will allow unlimited launches to try for the single longest flight. Round two will allow unlimited launches for a five-minute precision max. Round three will allow six launches (best five count with a two-minute maximum). This variety of rounds has proved to be very popular, and it results in a very exciting contest. There will be trophies for the top three places and many prizes. (Usually, everyone takes something home.) They'll also raffle a completely built HLG with radio. If you like HLGs and can make it, this is the event to be at!

Joe Wurts with his "Glass Bag" hand-launcher. Model features glass-bagged foam-core wings—rather unusual for an HLG.

I wish those modelers who stay away because of the size restriction would try one of the 60-inch HLGs. I've attended a few hand-launch events where there were no size restrictions, and most of the top places were won by models with spans of 60 inches or less. Without *some* restrictions, holding an HLG contest would be like holding a two-meter event and then allowing someone to enter with an unlimited ship. Also, there's more design development required (thus improving the breed) to get top performance when you must work within certain parameters.

Mike Charles (a member of our last U.S. F3E team) spent considerable time and effort with a computer design program to develop his hand-launch Ultra. It's an extremely clean design (60-inch span) with a pod-and-boom fuselage and a Gottingen 795 airfoil, and it uses rudder and elevator controls. Mike even designed the fuselage pod so that it would have Laminar airflow. I wonder if Mike would have designed and built such an interesting model if he hadn't had to stay within the size restriction for most HLG contests?

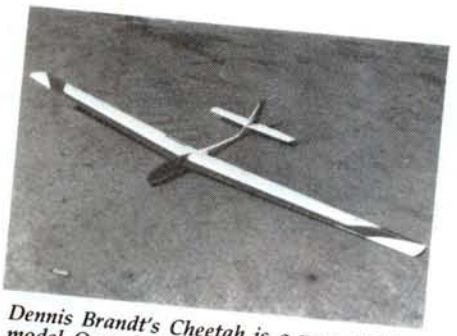
At the Harbor Soaring Society's second Annual HLG contest last year, there were no restrictions on size. The event was won by Joe Wurts with a 70-inch-span model that we dubbed the "Glass Bag." It has glass, bagged, foam wings using the RG-14 airfoil (an F3B high-speed section); a balsa fuselage; symmetrical, sectioned, foam tail surfaces; and a flying weight of 19 ounces. It's an unusual design concept for a hand-launch, but did Joe win because of its size? I've seen Joe fly a Flinger and still blow everybody away—including yours truly! Of the top five planes at this contest, three were over 60 inches (one was 66 inches with about the same wing area as most of the 60-inchers) and two were 60 inches or less. I'm sure I've

(Continued on page 80)

Brian Laird and his friends at Bluff Cove, CA, really like PSS. Typical weekend activity finds many scale slopers in attendance.

Hobby Shack's new EZ Elec 1800 comes completely built and includes the motor, gear drive, folding prop and spinner. Should be a good all-around sport model for the beginner and expert alike.

Slope Scale P-51 by Gary Kawamura. Gary spent 26 hours on the finish of this sharp-looking sloper. Considering the beating most slopers go through, Gary must be a pretty good pilot!



Dennis Brandt's Cheetah is a very striking model. Overall clean design makes the Cheetah a real contest winner.

An R/C Christen Eagle performs a low, knife-edge pass. Aerobatics is thrilling to perform and to watch.

THE NEED TO TURN AND BURN

AEROBATICS

by MIKE LEE

AEROBATICS IS ONE of the most thrilling aerial events to watch. From the fighter jets of the USAF Thunderbirds, to the antics of a J-3 Cub, we all enjoy the thrill of seeing airplanes perform death-defying stunts. During wars, the heat of combat forced more imaginative pilots to do evasive maneuvers to avoid being shot down. These maneuvers were exciting to watch, and public demands to see them were soon heard. As aviation progressed, so did the sophistication of the maneuvers. This improvement continues, and we've now reached a high standard of aerobatics with F-16s and Lasers. With lives at stake, practice and timing are paramount.

Dotty and Roy Speights with Roy's Atlanta flown in FAI. Typical of today's fast AMA pattern machines.

R/C modeling has progressed along almost the same learning curve as full-scale aviation. Early single-channel radios limited our maneuvering to the mere disruption of straight and level flight, and stunts showed the inherent stability of the models. For example, you could do a really steep diving turn and then let go of the stick, and this allowed the model to return to stable flight at high speed. The high speed resulted in a high-enough lift for the ship to do a loop.

With the advent of modern, digital, proportional radios, models have reached, and actually exceeded, the same level of control as full-scale aircraft. Our stunts can be more daring and violent than those which a full-scale plane can ever hope to perform. The main difference is that *our* progress took only a couple of decades instead of almost a century.

Luckily for us, we not only have the thrill of watching, but we can also please others with our aerobatic performances. Model stunt flying is limited only by our ability to devise and perform these stunts with today's strong, highly maneuverable aircraft. It's not difficult, and if you're learning, right here is a good place to start.

A Zlin 526 (behind) and Tipo 750+ are examples of modern aerobatic-type ships.

Aerial stunts are based on three basic maneuvers: the loop, the roll and the stall. These three maneuvers encompass the basic types of aircraft movement:

roll, pitch and yaw. Combinations of the loop, roll and stall provide the various stunts possible. Now that you have that, let's look at how to start performing aerobatics, not only for yourself, but for others too.

The easiest stunt to tackle is the loop. Simply put, this is a vertical circle in the sky using nothing but the pitch axis of movement. Lots of pilots do this one by just hauling back on the stick and watching the bird chase its tail, but a graceful loop involves more than that.

Rule of thumb number one in aerobatics: Always begin the maneuver with the aircraft straight and level. Ninety-nine percent of all maneuvers start from straight and level, whether the ship is inverted or upright. This also gives you the best chance of performing the maneuver the way it should be done.

In the case of the loop, we start here at straight and level. With the aircraft straight, level and heading into the wind, begin pulling back on the elevator stick, but only to about halfway back. Don't yank on it; just give it a gentle pull that takes about two seconds to reach. The ship should ease upward into a smooth, vertical arc heading for the top of the loop. At about the 10 o'clock position, the ship begins to unload from the vertical arc, and you can actually start easing off the elevator as the ship comes over the top. Keep the wings level at all times. As it pulls over the top (at about the 2 o'clock position), you must start easing that elevator back in again to start pulling out the nose through the bottom. Throttling back will help keep you from over-stressing the ship. As the ship hits straight and

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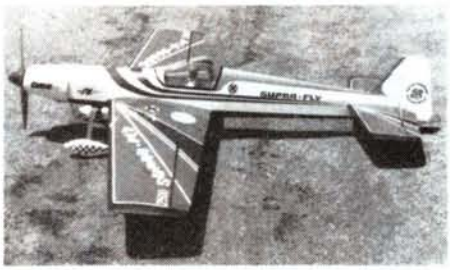
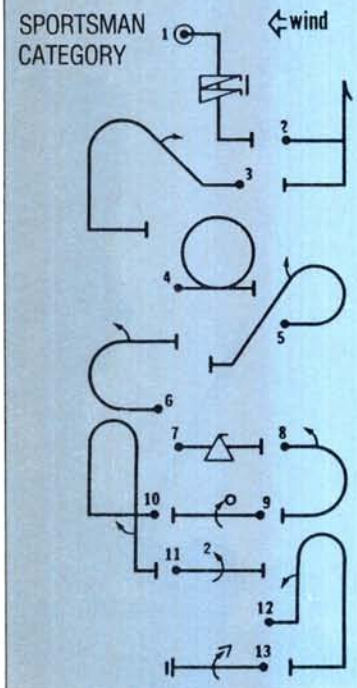


The Supra-Fly, designed by Hanno Prettner, is a state-of-the-art aerobatics ship for R/C. It closely resembles the shape of many full-scale aircraft.

Above: *T. Yoshioka looks at his Laser 200 from behind. This former World Champ flies scale-type ships in dazzling aerobatic displays.* **Left:** *Don Weitz shows how a modern aerobatic plane can be both scale and a good performer. This Zlin 526 has taken Don to the winners' circle many times.*

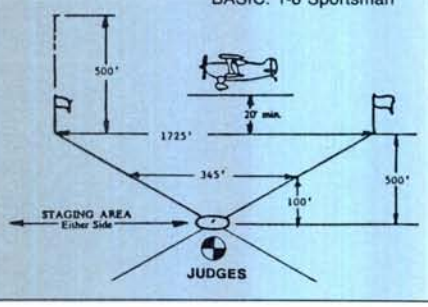
SPORT AEROBATICS SEQUENCE

SPORTSMAN CATEGORY



1. 2-Turn Spin
2. Hammerhead
3. Half Reverse Cuban 8
4. Inside Loop
5. Half Cuban 8
6. Immelmann
7. Inside Snaproll
8. Split Ess
9. Barrel Roll
10. Humpty Bump ½ Roll Dn.
11. 2-Point Roll (3-Seconds)
12. Humpty Bump ½ Roll Up
13. Slow Roll (3-Seconds +)

BASIC: 1-8 Sportsman



Engine Review

by PETER CHINN

Almost half-a-century apart! The author's original 1940 model O.S. Type-6 (left), alongside first example of limited-edition O.S. Type-6 Replica, Serial No. 0001.

O.S. TYPE-6 REPLICA

THE EXISTENCE OF SAM (the Society of Antique Modelers) and MECA (the Model Engine Collectors' Association) and similar groups in other countries, attests to the widespread interest in old model-airplane engines. However, the demand for old-style engines (especially pre-1950 spark ignition motors) far exceeds the numbers of such engines still in circulation.

As a result of this, many replicas of old designs have appeared during recent years, among them such collector's items as Herb Wahl's "40th Anniversary" Brown Junior (of 1975) and other American classics such as Super-Cyclones and Orwicks.

Most of these reproductions are the work of a few dedicated specialists who, in many cases, have produced better engines than the original versions of 40 or more years ago. In England, for example, a small precision-engineering firm called Dunham Engineering, directed by Alan Holmes and his sons, has produced some excellent replicas of pre-1950 British and American engines, all subtly modified for improved durability and performance.

Until recently, no major model-engine manufacturing company had re-introduced one of its *own* early designs, because few (K&B and Fox are notable exceptions) were in the model engine business before 1950.

Translucent fuel tank holds one ounce of gasoline/oil mixture: enough for 5-6 minutes or running time!

SPECIFICATIONS

Type: Air-cooled, single-cylinder, side-exhaust, spark-ignition 2-stroke-cycle, with induction through piston-controlled cylinder port and crossflow scavenging.
Bore: 0.9055 inch (23mm)
Stroke: 0.9055 inch (23mm)
Displacement: 0.5831 cubic inch (9.556cc)
Nominal Compression Ratio (full stroke): 5.8:1
Speed Control: No throttle. Limited, manual, speed adjustment via ignition timing lever and needle valve.
Checked Weights: 11.6 ounces (330 grams) with fuel tank; 13.4 ounces (380 grams) with tank and ignition equipment, less battery.
Mounting Dimensions:
Crankcase width: 39mm
Length from prop driver face, including tank assembly: 121mm
Height above CL, including spark plug: 106mm
Mounting-hole spacing: 46.5x15mm
Manufacturer's Claimed Power Output: Not stated.
Manufacturer: O.S. Engine Mfg. Co. Ltd., Higashisumiyoshi-ku, Osaka 546, Japan.
U.S. Distributor: Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

Type-6 Replica faithfully follows original engine's construction methods, but has advantage of modern standards of precision engineering.

O.S. Type-6 Replica is supplied ready-mounted on hardwood display block, as were many engines of the prewar era.

This situation has been changed by the entry of the Japanese O.S. company into the "replica" market. As regular readers will be aware, O.S. first started making model engines more than 50 years ago. Their first production engine, the O.S. Type-1 of 0.10-cubic-inch displacement (one of the smallest displacement engines available at that time) appeared in 1936. All early O.S. engines (with the exception of an in-line 3-cylinder marine engine made in 1938) were identified by type numbers. The Type-2 was marketed in 1937 and was much larger at 0.42 cubic inch. In 1938, it was followed by the 0.45-

O.S. TAKES US BACK TO THE FUTURE... REFINED JUST ENOUGH TO BE CONTEMPORARY

cubic-inch Type-3. The Type-4 (0.28 cubic inch) and Type-5 (0.33 cubic inch) appeared in 1939.

In 1940, the 0.57-cubic-inch Type-6 (known in Japan as the "K-6") was released, and now the factory has issued a "limited edition" replica.

Just how closely the Type-6 Replica resembles the original engine can be seen from the photographs. One of these shows a 1940 model from my own engine collection, alongside a recently acquired 1987 model, which is officially the first production K-6 Replica and carries the coveted serial number "0001."

Back in pre-World-War-II days, the materials and production methods used in the manufacture of commercial model engines were inferior to those available today. The O.S. Type-6 Replica is a faithful example of pre-war model gas-engine design, but it's engineered to a far higher standard than the original engine. Purchasers who intend to use the Type-6 Replica in an old-timer-type model, rather than merely to add it to a static collection, will appreciate its superior quality and greater durability.

Fuel and ignition parts, showing needle-valve assembly, tank and intake, NGK spark-plug and, in foreground, ignition-timer parts.

Remember that the original Type-6 and its contemporaries were only required to power free-flight models (control-line and viable commercially available radio-control systems had yet to arrive) and that these engines were very lightly stressed. Wing loadings and flying speeds were low, and engines were required to operate only for very short periods, i.e., long enough (perhaps 30 to 60 seconds) to take a model up to a height from which it would glide to earth within a reasonable distance. By contrast, today's old-timer free-flight-type models usually have added radio-control guidance, and engines are run continuously for long periods.

The basic design of the Type-6 is fairly typical of the period: a simple crankcase with bushed main bearing and screw-in backplate; a lapped cast-iron piston running in a steel cylinder, flange-fitted to the crankcase; an integral cylinder-head; simple cross-flow scavenging; cylinder-port induction; an integral fuel tank and a make-and-break ignition timer mounted on the crankcase nose.

Examining the finely made parts of the Type-6 Replica, we find that its counterbalanced, hardened, alloy-steel crankshaft has a 10mm-diameter solid main journal and runs in a bronze bushing in the well-executed crankcase casting. The crankcase nose, which is machined to 14.5mm o.d., is clamped with the ignition timer bracket, so permitting the timer assembly to be smoothly rotated to adjust the spark timing. The timer points are opened and closed by a cam formed on the rear periphery of the steel prop driver, and this is positively located on the crankshaft by a Woodruff key.

In sharp contrast to modern conventional model 2-stroke construction, the cylinder perpetuates the design of the original K-6 by having a one-piece steel cylinder liner with non-detachable head. This includes an integral boss for the spark plug, within a cast-aluminum cylinder block that incorporates machined barrel and head fins, plus the intake boss and bypass and exhaust ports. The intake boss, at the rear, is threaded for the carburetor/fuel-tank assembly. The areas surrounding the bypass and exhaust ports are milled flat and tapped for the round-head screws that secure the bypass cover-plate and streamlined section exhaust stub pipe. The complete cylinder assembly is attached to the crankcase by a substantial base flange and two fillister head screws.

The ringless, cast-iron piston has a curved baffle and a large port window on the bypass side, and it's fitted with a 5mm-o.d. tubular wrist pin. As in the original engine, the long connecting rod (2X stroke between centers) is made of bronze.

Having an intake port in the cylinder, uncovered by the piston skirt (instead of the more modern arrangement of admission through a crankcase rotary-valve) means

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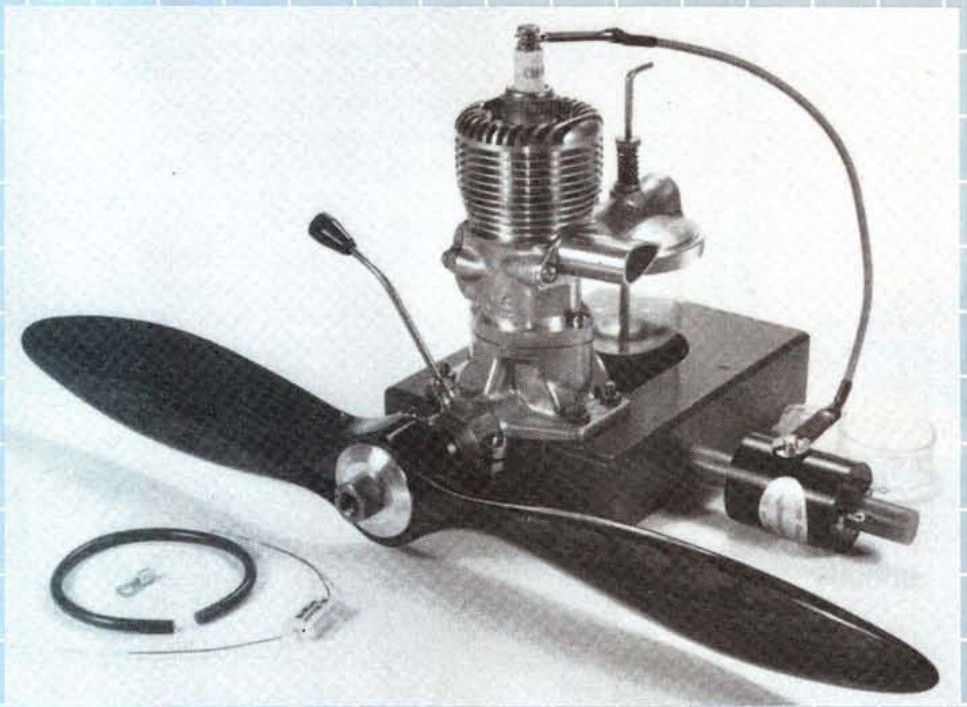
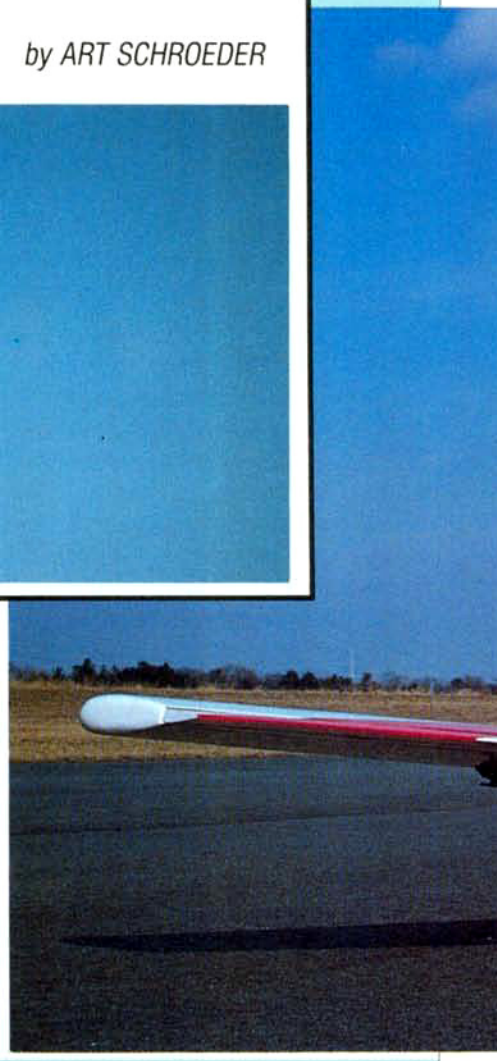


Type-6 Replica comes complete with ignition coil, clip, condenser and plug lead. Very expensive Japanese laminated hardwood prop, also shown, is not included, however.

BYRON ORIGINALS

BD-5J

by ART SCHROEDER



One of the newer Byron Jet offerings, this one should appeal to the foam-and-fiberglass-fan flyer.

JAMES BOND WAS in deep trouble; hordes of bad guys were upon him! But, as always, our intrepid secret agent had an answer. In the horse trailer just behind his escape car was the world's smallest jet airplane! Bond kissed the girl, leaped into the trailer and, in seconds, was in a BD-5J and airborne.

Of course, I was watching "Octopussy." The thrilling opening sequence showed all kinds of actions with the tiny red, white and blue jet. Not only did *I* see a new airplane that turned me on, but Bond also escaped while destroying the base of evil operations. The BD-5J is a modification of an earlier BD-5 prop-driven machine.

Designed by Jim Bede, the airplane was never a resounding success as a home-built, because a suitable powerplant wasn't readily available. However, four were completed in modified form with Ames/Microturbo jet engines. These aircraft are all flying at air shows around the U.S., at least two of them in Coors colors.

The BD-5J or "Acrojet" deserves its title of "World's Smallest Jet." Spanning only 17 feet (I've seen bigger models!), the tiny bird weighs only 432 pounds empty and 860 pounds gross. With 200 pounds of thrust, the BD-5J tops 285mph. Even though the movie display of this unique airplane had turned me on, there was no way I could ever build its unusual fuselage shape, and ducted fans were really for dedicated, expert modelers. This was true until Byron Originals* kitted a 2/5-scale version for us "fumblethumbs." This innovative, Iowa-based firm has made modeling history by marketing aircraft that have made ducted-fan flying a modeling reality for average fliers. The new BD-5J fits that mold. When I say, "relatively easy," I mean that the BD-5J will test your patience and skill on the bench, but it will also reward you with great flying.

SPECIFICATIONS

Model Type: *Ducted fan sport scale*
Wingspan: *87 inches*
Length: *59 inches*
Weight: *Design, 15 pounds; Review airplane, 14½ pounds*
Wing Area: *964 square inches*
Wing Loading: *34.6 ounces/square foot*
Power Required: *.65-.90/Byrojet fan*
Suggested Retail Price: *$423 (basic kit)*

Photos by Rich Uravitch.

CONSTRUCTION: The BD-5J follows the well-known Byron format: two-piece fiberglass fuselage, molded-foam, plug-in wings, all the necessary hardware, well-done vinyl decals, instruction booklet and a variety of printed plans and patterns. A departure from other Byron kits I've built (this is the eighth) are the built-up, sheeted tail feathers. They increase construction time, but I suspect that they're used to minimize weight.

Everything in this kit is of high quality, and I can't fault the contents. Instructions suggest a logical building sequence and provide enough information for builders who are experienced in fiberglass/foam technique

Byron BD-5J project foremen Kevin Bryant and Dave Hoover flanked by BD-5Js.

11,672 Coors Light Cans??

DOES THAT THING REALLY FLY? This is a question the Silver Bullet pilots hear repeatedly—until they slide into the cockpit of the world's smallest jet and perform an astounding display of aerial artistry.

Not only does the Silver Bullet fly—it zooms straight up, straight down, inverted and even backwards. While reaching speeds of 300mph or performing a 16-point roll, the pilots narrate their performance from the cockpit for the audience to hear. During the most intricate maneuvers, they calmly ad-lib with the air show announcer, so providing a unique dimension to air show entertainment.

"I understand why people question the flying ability of a 12-foot-long, 432-pound jet," said Bob Bishop, the original pilot of the Silver Bullet team. "I built a version of the BD-5J in 1976, and I've been flying it in air shows ever since. Spectators everywhere are amazed by the speed and maneuverability of this super small jet."

Building the world's smallest jet took a little ingenuity, more than 3,000 hours of labor and the equivalent of 11,672 Coors Light beer cans. Built mainly of light-gauge aluminum (similar to beer-can aluminum), the Silver Bullet stands less than four feet tall at the cockpit and weighs only 432 pounds (less than many motorcycles).

With a total length of 12 feet and a wingspan of 17 feet, the jet can go just about anywhere. Just one bolt secures each wing, and without the wings the jet fits through a 4½-foot doorway into television studios, malls and its traveling trailer.

While the design of the Silver Bullet is basically simple, the craft does incorporate several features found only on modern, high-tech fighter aircraft. Among these features are 30-degree reclined seating (to reduce pilot fatigue during high-stress maneuvering), wrist-operated side-stick flight controller, computer-controlled automatic-sequence start with overspeed monitoring and electronic fuel metering.

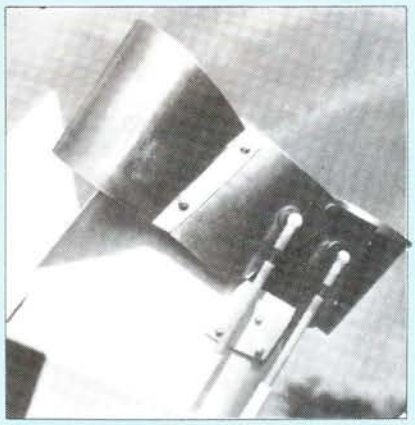
Silver Bullet pilots Bob Bishop and Dave Hoover have teamed up to present what is currently the only jet aerobatic team performance by civilians. Their spectacular close-formation aerobatic show combines precision, skill and humor to produce a totally unique performance.

The cockpit dialogue helps set the stage for a novel story line as "newcomer" Dave Hoover "wrestles" with the pressures of close-formation aerobatics. A couple of "miscues" have startling and comical results. The resolution of their difficulties forms the basis of an extremely beautiful and graceful presentation and leads to the exciting climax of the show, where Bishop and Hoover duel for the title of Silver Bullet "Top Gun."

The Silver Bullet Formation Jet Show will be performed at selected sites, including the upcoming Byron Originals Aviation Expo '88, on August 10 through 14.

and ducted-fan complexity. The printed material assumes a high degree of proficiency, and completion by a novice might be nearly impossible. However, the BD-5J isn't really intended for the novice. Several less complex fiberglass aircraft should be under your belt before you attempt this project.

I followed the suggested building sequence, and I suggest you do the same to avoid "painting yourself into a corner." Building begins with the horizontal and vertical stabilizers. These are built-up sheeted structures


Optional thrust attenuator. Linkage drives clam shells closed, reducing thrust. Nice for getting "on the pipe" for takeoff.

that require you to cut parts from sheet wood using full-size templates. I used Elmer's Glue Stick to affix templates to the wood, pinned two sheets together and cut out all the parts in one band-saw session. The horizontal stab is built on a jig made of 1/16-inch music wire and some wood blocks. Be sure you have a flat surface to set the jig on, thereby avoiding warping. The strakes take thought to develop properly; study


Retractable nose-gear installation. Door linkage is simple, positive.

Art was so pleased with his BD-5J that he plans another one. Not a kit for the novice, but worth the trouble.

the plan and photos carefully. When the sheeting is in place, the structure becomes very strong and rigid. Vertical fin and rudder assembly is straightforward.

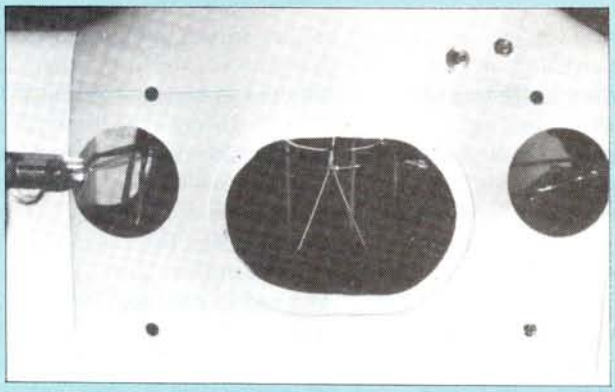
When sanding the tail feathers, don't be too aggressive, since it's easy to sand the sheeting too thin. Just as important, be careful when sheeting the strakes to avoid misalignment. Once the stabs are done, the fuselage work begins, and it's here that patience is truly a virtue. It would help to have hands with eyes when working on the BD-5J, because many operations are done in extremely tight quarters where you really can't see and have to work by "feel!" A good example of this is the installation of former F-10 (support plates for flap bearings). These are installed immediately behind F-4 and must be fitted and glassed completely by feel. Don't give up; the flaps on this bird are very nice. Formers F-5 and F-6 are also difficult; not too difficult to put in place, but tricky to glass.

Now-standard practice of one servo per aileron used on larger airplanes. Straight, direct linkage eliminates slop and minimizes flutter potential.

In many cases, I was only able to get strips of fiberglass cloth on one side of a given former. Where this was the case, I flowed some resin into the joint on the unglassed side. The result seems quite solid, and I've had no problems. As the instructions indicate, cut the strips of cloth 45 degrees into the weave, and don't try to glass long strips into place. I used 3-inch strips, and that length was both easier to install and produced a neater result. Be sure that all surfaces to be glassed have been cleaned with acetone and scuffed with sandpaper.

Fuselage work involves some cutting out to make chambers or air ducts and a nose-gear door cover. I used both a Zona saw and a Dremel router to do

(Continued on page 82)



This is not a cheater hole. Removable panel provides access to innards and linkages.

About Those Engin

by JOE WAGNER

I HEARD RECENTLY from Jim Holmes, newsletter editor for the Lexington (Kentucky) Model Airplane Club. He asked me a few innocent-sounding questions about model engine operation:

"Will I need to set my needle valve richer or leaner as the weather changes from cool to hot? Will I need to run leaner or richer as the humidity increases? Finally, when I find the correct needle setting for a particular day, will my engine then develop more power when the weather turns cooler or warmer; drier or more humid?"

These questions seem simple, but the answers to them are rather complex. First, any internal combustion engine performs best when the air is cold and dry. Back in my sports-car-racing days, we used to figure that for every 10 degrees of air temperature change there would be a two percent variation in engine power. As the weather cooled, the power increased, and vice versa. This also holds true for model motors.

Cold air is denser than warm air, and thus contains more oxygen per cubic inch. Dry air also has more oxygen per cubic inch than humid air, because water vapor in the atmosphere displaces some of its oxygen content.

Easy enough so far, but here come the complicating factors! First, most

Early glow plugs. The round-top Arden plug on the left was first, followed soon by Champion (large and small sizes shown) and Ohlsson & Rice.

A 1948 McCoy .60 sparker equipped with a high-compression "Denver Head" running in an OT R/C model at a contest near Denver.

glow fuel contains nitromethane. During combustion, this sets free additional oxygen. It's exactly like the action of potassium nitrate in "black" gunpowder. When that's ignited, it liberates sufficient oxygen to instantaneously combine with the particles of charcoal and sulphur in the powder (which comprise roughly two-thirds of the total mixture). This is what generates gunpowder's well-known explosive force.

Because of its extra oxygen content, the nitromethane percentage in glow fuel is more important to the engine's output than the surrounding air temperature or humidity level. But the more power an engine puts out, the more waste heat it develops. If this heat isn't carried away rapidly enough (as when the air temperature is up into the 90s or higher), the fuel/air mixture coming into the overheated cylinder tends to begin burning too soon when the piston nears the top of its stroke, and that causes a power loss.

There are so many variables! The kind of oil in the fuel has an important effect. Synthetic oil doesn't stand up well to high heat; it decomposes and loses lubricity. Castor oil is a far better lubricant for glow engines, but if it gets *too* hot it thickens excessively, turns into "varnish" and so slows a motor down. Too little oil in a fuel blend also causes a power loss, due to increased friction.

The smaller the engine, the more cooling surface it has in proportion to its displacement; that's why 1/2A motors run best on high-nitro fuel. (Cox's* Racing Fuel blend is about 30 percent nitromethane.) Even in hot weather, small motors can rapidly dissipate the waste heat that high-nitro fuels produce. But some larger engines, e.g., certain Foxes, were purposely designed to hold internal heat. Such motors can run well on FAI-type fuel (which contains no nitromethane at all), yet give trouble at times with standard

Joe holds a pair of what this column is all about.

fuel.

Because all these factors are involved, it's impossible to come up with an exact formula for operating model glow engines. Most modelers just go "by ear" and set their needles to whatever sounds about right.

That's what *I* do, but I never try to achieve a "peak" setting for maximum rpm! I always run my motors a little rich. Model engines have such a high power-to-weight ratio that the small loss of top-end rpm from rich running is negligible. A rich mixture provides a safety factor in case something happens to reduce the fuel flow through the needle valve: a bit of dirt perhaps, or a tight maneuver...

To sum up: Model engines generally

"Blendzall" castor oil mixes readily with gasoline. The antique glow fuel is almost 30 years old and is still as good as ever.

develop more power when the air is cool and dry than when it's hot and humid. (Propellers are more efficient under these conditions, too.) Needle settings depend on the motor design, as well as type and age of the glow plug, the fuel blend (oil and nitro percentages) and the size and pitch of the prop.

There are simply too many interacting variables in model-airplane engine performance for any rigid operational formula to be valid. Like many other skills, running glow engines is much more of an art than a science. That's how I answered Jim Holmes. In responding to readers' letters, I try to give specific answers whenever possible, but sometimes there *aren't* any specific answers. That's one of the things that makes flying model airplanes such an interesting and challenging activity. Not everything is known about it yet, and plenty of room for exploration and experimentation remains.

My mention of the action of nitromethane brings something else to mind. Before glow plugs came along, and while spark ignition and gasoline-and-oil fuels were standard for model engines, several motor manufacturers, such as McCoy and Super Cyclone, sold special high-compression heads for their engines. These were intended for modelers living in high-altitude areas, like Denver, CO, and Salt Lake City, UT. The extra compression compensated for the thinner air.

Also, in those days, some makes of model engines were purposely designed to have more compression than others (as they still are today, to some extent). For example, the 1947 OK B-29 and the Mohawk Chief had noticeably higher compression than a Forster .29 or K&B's* Torpedo. Consequently, the OK and the Mohawk were more popular in the Denver area. They ran better at high altitude than motors with milder compression ratios.

The glow plug and the addition of

(Continued on page 38)

ABOUT ENGINES

nitromethane to glow fuel changed all that. Now you can get essentially the same performance from any given engine anywhere in the USA, merely by choosing the proper glow plug and blend of fuel: more nitro for higher-altitude locations.

This doesn't mean that model *airplane* performance is unchanged at altitude, however. Propeller efficiency and airfoil effectiveness both suffer in thin air, in hot weather and in high humidity.

I have a 1/2A R/C old-timer model that flies well in western Pennsylvania, where the altitude is about 1,000 feet above sea level, and the air temperature seldom exceeds 80 degrees. A few years ago, I took this airplane to La Junta, CO, which is 3,300 feet higher than my home field. The weather was hot and humid; on one day, it was almost 120 degrees by lunch time! I had no special problems getting the motor to run well, however. By switching to Cox's Racing Fuel (instead of the milder Glow Power blend I normally use), I got about the same rpm from the old-timer's engine at La Junta as I do at home.

But the model wouldn't fly! Even from a hand-launch, the best I could achieve was a stretched glide. The combination of high altitude, temperature and humidity thinned the air too much for my propeller and wing to function effectively, even though the engine ran well.

Lately, I've been discussing the suitability and availability of various lubricants for model airplane motors with Jerry Price, from Warren, MI. Jerry flies all types of engine-powered models and uses both glow and spark ignition. Like many other modelers with similar interests, Jerry has found it difficult to locate SAE 70-weight oil for use with gasoline to make the 3-to-1 fuel for his spark-ignition motors.

This oil was common enough over 40 years ago, but it's rarely seen today. One source is Herb Wahl*. Because of packing and postage costs, Herb has to charge about $5 for a quart of SAE 70. This is enough for a gallon of 3-to-1 mixture, which is plenty for any amount of spark-ignition model flying. One ounce of this fuel will run an engine such as a side-port Ohlsson 23 for six or seven minutes.

However, gasoline-based model fuel

(Continued on page 98)

CARL GOLDBERG MODELS

SUPER CHIPMUNK

by RON FARKAS

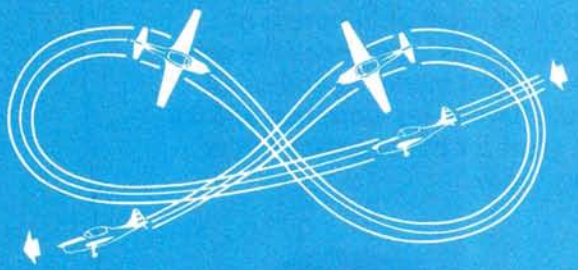
HERE'S AN action-packed model airplane from the good folks at Carl Goldberg Models*—the same people who taught many of us how to fly with designs like the Falcon and the Eagle. For years, I've thought of Carl Goldberg Models as a conservative company that caters to beginners and low-key sport fliers. The first hint that something else was going on was when they came out with the J-3 Cub—a pussycat for sure, but quite a scale-like model. This time around they must have let one of their hot pattern fliers loose in the file of three-view drawings, because you couldn't ask for a more striking and aerobatic stand-off scale model than the Super Chipmunk in the color scheme of the late Art Scholl.

This *isn't* a model for beginners! A lot of the structural features resemble those of the Eagle and Sky Tiger models, but the construction is more involved, and the flight performance is decidedly on the *hot* side. It might be suitable as a first low-wing airplane for a pilot who has sufficient aileron flying experience, but this will depend on the engine size selected by the builder. A competent sport flyer will probably feel quite comfortable with the Super Chipmunk, and a *very* experienced pilot will appreciate its aerobatic performance capabilities.

The basic fuselage structure comprises a light plywood-box section with balsa-sheeted foredeck and turtledeck surfaces. The wing structure includes ribs, spars, shear webs, sheeting, capstrips and a milled-balsa leading-edge cap. The fixed tail surfaces are sheeted-balsa frames, while the movable surfaces are open framework.

SPECIFICATIONS

Type: *Semi-scale sport*
Span: *64 inches*
Weight: *6 to 8 pounds*
Area: *688 square inches*
Wing Loading: *25.1 ounces per square foot at 7½ pounds*
Power Required: *.45 to .60 2-stroke, .60 to .90 4-stroke*
Number of Channels Required: *4 to 6*
Suggested Retail Price: *$109.95*
Features: *Light plywood fuselage structure, built-up wing. Molded canopy, cowl, fairing, wheel pants. Optional flaps and retracts.*



CG's newest sport scaler; this "right" size acro follows its full-scale counterpart in flying ability!

Apart from a few minor flaws, which I'll describe later, the instruction manual is a typical outstanding Goldberg effort with photos and numbered assembly steps. Two folded plan sheets were provided; the wing panels on one and the fuselage and tail on the other. The die-cut balsa and light plywood parts were of good-quality wood and relatively cleanly cut. The balsa and bass strip wood were well cut, and the wing sheeting was of a good medium density. The die-cut fuselage top sheeting was rather hard, but nonetheless usable. An extensive assortment of high-quality Goldberg hardware was provided, including molded

Photos by Rich Uravitch.

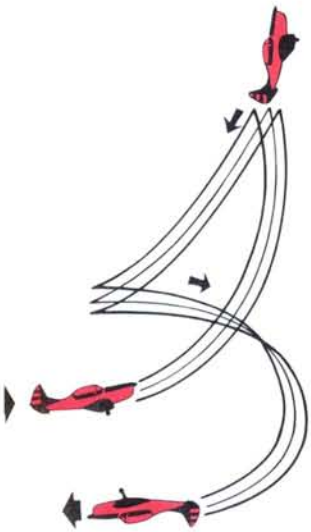
nylon T-shape engine mounts. A vacuum-formed cockpit interior and wheel pants were included, as was a beautiful, clear, bubble canopy. The cowl halves were vacuum-formed from a heavy-duty plastic material (probably ABS). A really superb set of self-stick decals was provided for the Art Scholl sponsors' markings. In general, the kit engineering and materials were all very good.

CONSTRUCTION: By following the illustrated instruction manual and using Goldberg Jet and Super Jet CA adhesives, construction proceeds very quickly. The tail, wings and fuselage are built in that order. To start the tail, the framework is first assembled over the plan from a combination of die-cut parts and strip stock. The fixed surfaces are then sheeted on both sides with 1/16-inch balsa, giving a total thickness of 5/16 inch. Since the movable surfaces aren't sheeted, they're constructed from 5/16-inch stock with tips that are each laminated from three die-cut pieces.

Although the wing airfoil is a symmetrical section, each panel is started upside-down right on the board, since three of the ribs have feet attached. First, these three ribs are placed on the main spar, and the notched trailing-edge spar is attached to them. My spars were about 1/8 inch shorter than shown on the plan. Then, the remaining ribs are located and glued into position, followed by the other main spar. Next, the grooved plywood landing-gear block is installed along with the forward spar and the trailing-edge sheeting. I noticed that the true position of the landing-gear block was farther aft than shown on the plan, but it didn't matter, as the block mated with all the die-cut notches in the ribs, and the photos matched the actual assembly. The surface of the block should be raised exactly 5/64 inch so that it will be flush with the sheeting. The bottom leading-edge sheeting is then installed, after reliev-

Ron checks the throttle response just before takeoff.

Very attractive rendition of the late Art Scholl's personal Chipmunk. Markings supplied in kit.



ing it to clear the landing-gear block. This is followed by the center section and tip sheeting (which are die-cut to produce rounded contours adjacent to the open rib bays) and finally by the capstrips.

At this stage, the panel is removed from the board, and the feet are trimmed off the three ribs. For the next steps, the panel is flipped over and secured to the building board using neat little plywood jigs to maintain true alignment. The shear webs and upright landing-gear torque blocks are then installed. The preceding steps are repeated to build the second wing panel. The panels are then joined, along with the light-ply dihedral braces. While this is being done, one panel is held in the jig supports, and the other is elevated by a die-cut gauge near the tip. This is an excellent way to achieve the correct dihedral and a well-aligned center joint, although some trimming was required to make the dihedral braces fit.

The instructions never tell you to install the forward top spar, but you can figure it out from looking at the construction photos. After installing the center rib and dowel mounting block, the entire top of the wing is sheeted in the same way as the bottom.

Next comes the milled-balsa leading-edge cap, and this is where I encountered the only significant problem with this kit. After block-sanding the front of the ribs, I trial-fitted the leading edge, and didn't think it was wide enough for a good glue joint against the top and bottom sheeting. So, to be on the safe side, I replaced the kit pieces with a standard-size shaped leading-edge stock that was 1/16-inch wider. After installing these, I sanded the new material to the proper radius. I contacted the manufacturer about this, and I was told that the milling specification would be checked. In a more recent conversation, I've learned that the leading-edge width has been increased for the next production run.

The plastic wing tips went on easily, but care was required in sanding the sheeting to match the tip contour. The trailing edge of the plastic tip seemed rather vulnerable, so I added 1/4-inch balsa reinforcement to its exposed inboard face. With the addition of the tapered ailerons and center-section trailing edge, the wing was almost finished. Plastic bottom fairings have to be installed after the wing has been fitted to the fuselage. The Super Chipmunk kit includes wing flaps and their torque-rod linkages (if you care to use them). An optional retractable landing-gear installation is also shown on the plan and in the instruction booklet.

In typical Goldberg fashion, the fuselage can be partially assembled without glue, by interlocking the sides with the formers—top and bottom parts that are all die-cut from light plywood. Then Jet or Super Jet adhesive is run into all the seams to bond the parts together. This produces a solid and well

READER REPORTS!

MINI FIELD & BENCH

SUPER CHIPMUNK

Edward L. Fry, Altoona, PA

A Reader Report? What a great idea! I get to brag about my Chipmunk and possibly earn a free subscription to your great magazine!

I bought my kit in early October from my local dealer, who had a little trouble getting it as it's so new. My Chipmunk was built in two weeks of evenings. I used Webra's new 81 Speed with a 12-6 Master Airscrew in a true-turn aluminum spinner, Black Baron Film (their new metallic red and blue) and Duplicolor paint on the cowl—all surprisingly fuel-resistant. I also used an Expert 7-channel with flaps and a smoker.

I've built many kits, both for myself and for others, and this was the easiest plane of its type to build. You put the fuselage together with rubber bands, align it on the plan, then Jet the whole thing together. It doesn't get easier than that! The wing goes together almost as easily and comes out beautifully true.

However, I do suggest that all builders of this kit discard the four small, laminated-plywood, grooved blocks for the landing-gear wire-uprights. One "touch-and-go" with a little too much touch and not enough go and your fixed gear, pants and all will become retractable, punching a messy hole right through the wing. As an alternative, I suggest a rectangular hardwood block, epoxied to the wing-rib doubler. This is much sturdier.

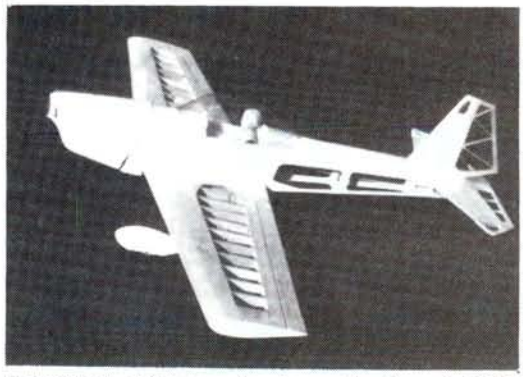
Goldberg's new ABS-style formed parts glue beautifully, but are a tad too brittle. The pants attach very cleverly and hold up fairly well. However, fatigue cracks developed in the cowl, and I had to glass-cloth and Jet the inside to stop it. When this is done, it makes the cowl very strong indeed.

The cockpit detail is excellent, but I hope they'll eventually supply a custom pilot too. The interior is one piece and folds into position after painting—*very* realistic! The decals are fantastic; as you spend all that time cutting them out, think about how difficult they'd be to make yourself.

My bird ended up at 9 pounds, but this isn't a problem at all. Flying the Chipmunk is a blast. I cranked up my throws and thought I'd rely on low rate for landing, but I've never even flown on low. I seal the control surfaces on my planes to keep the gunk out and to improve control response. Snap rolls a la CAP 21, knife-edge forever, loops squeaky-tight with ¾ flaps, rolling circles, inverted with 1 or 2 clicks down-trim, slow fly-bys—remarkably slow for a pattern grade ship (Goldberg has washout on the wing). With flaps deployed, you can control descent with throttle; it won't snap onto the runway, but will just settle on the mains. The worst you'll do is crack a pant and nose over to scuff the cowling. (Can't say that about a Kaos or CAP 21.) With the Webra 81-speed, this baby goes straight up on takeoff.

I recommend the Chipmunk as a first low-winger. At 64 inches, it's not too small or too unwieldy to transport. (Fully assembled, it fits into my hatchback.)

I'll say it again: This kit is the easiest to build, best-flying bird of its type I've ever had the pleasure to own, *and* it's scale!



Completed airframe prior to application of CGM Ultracote.

aligned basic structure. Next, the upper formers are added, and balsa stringers are glued into their respective notches.

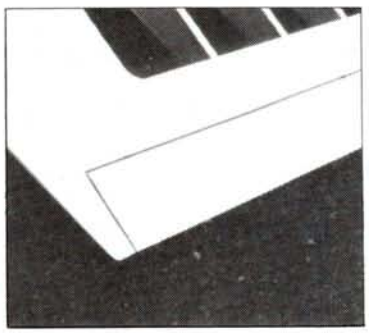
Before sheeting, an inset ⅛-inch-square frame is installed around the perimeter of the top piece to increase the gluing area where the sheet meets the sides—a nice feature. The foredeck and turtledeck are each sheeted with several pieces of die-cut ⅛-inch balsa. Due to the firm density of the wood, to form the contour, I had to soak it and hold the parts in position overnight using an Ace bandage. After that, they were trimmed for a good fit and glued permanently with Slow Jet and a spray of Jet Set accelerator.

SUPER CHIPMUNK

Basic fuselage structure prior to installation of top sheeting.

Fuselage wrapped with Ace bandage while the turtle-deck and foredeck sheeting dries to shape.

The horizontal and vertical tail surfaces were installed next, along with filler pieces and balsa-block fairings. I used scrap to compensate for the filler pieces being a little too shallow. Installation of the dorsal fin wasn't explained in the instructions, but this was obviously the appropriate time to glue it into position.



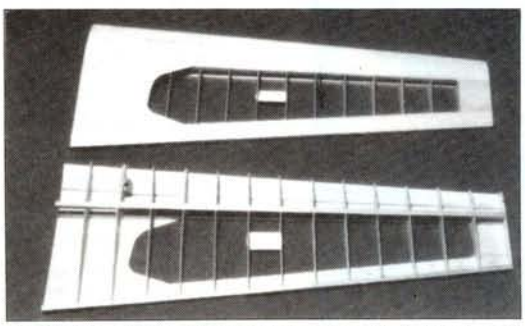
Close-up of author's modification to wing tip for additional strength. Balsa reinforcement installed at trailing edge.

When installing the rudder pushrod, I ensured that its location would avoid the external bend that was shown on the plan. A fixed elevator center-section filler piece is included, but it isn't permanently installed until the elevator is hinged. If used "as is," this filler isn't as thick as the elevator itself, so I laminated it to a piece of scrap sheet prior to installation.

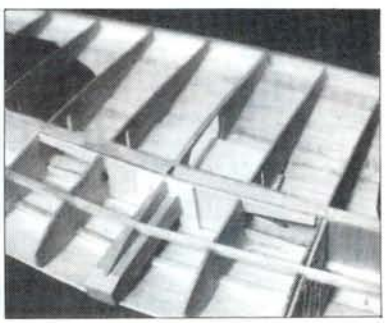
Next, I trimmed the cowl to clear the OS* .61 FSR engine and Tatone* Pitts-style muffler. Sensibly, this is to be done before joining the cowl halves. While the illustrations show only the use of a modeling knife, I found it much easier to drill a pattern of ⅛-inch holes and then cut through them to make the rough opening. I then used a Dremel tool with a sanding drum to finish the job. Initially, the muffler wouldn't clear the engine mount, so a machinist friend made a ¼-inch thick aluminum spacer to lower the muffler.

I chose Carl Goldberg Ultracote iron-on plastic covering material to duplicate the Art Scholl color scheme. It's very easy

(Continued on page 90)



Basic wing-panel structure showing ribs, spars and sheeting.



Close-up of center-section structure showing light plywood dihedral braces.

Pattern Matters

by MIKE LEE

BY THIS TIME OF YEAR, I hope you've prepped the old workhorse or put the finishing touches on a new warbird for the upcoming season. In case you haven't, here are a few reminders to help you get your steed in good shape and ready for action.

First, make sure that the batteries are up to snuff. If you have a battery cycler, perform a charge/discharge cycle; not once, but at least twice to ensure that the battery performance is consistent. There's nothing more discouraging than getting your bird up the first, second and maybe the third time, only to have it sent back to the factory in smaller, inoperative pieces because of a bad battery pack. This is one item in the radio section where you must say, "When in doubt, throw it out."

If you find that a new battery is in order, consider replacing a standard 500mAh pack with a newer 800 or 1,200mAh pack for increased capacity and insurance against disaster. Several radio manufacturers have made these available, as have after-market dealers who make large-capacity packs for us. These larger batteries not only provide a fresh and reliable power supply, but also lengthen flying times, allow a larger margin for error due to servo stalling and offer peace of mind. Worth every penny!

Just because the pack is new, it doesn't mean that you can skip the cycler. Put that baby to the test—just in case. Bad packs sometimes come fresh from the factory.

Next, inspect all the wiring. Check the main harness for stiff or bare wires, breaks or kinks.

A stiff wire indicates two things. First, you might have a low-quality wire, and that's going to cost you money in the future. If it won't flex well (and flex it must, in order to absorb vibration and motion), it will break. Second, a stiff wire often means that the insulation is old and brittle. Embrittled insulation will eventually crack, and you'll then have bare wires. Time to replace it with new wire! If you aren't confident that you can safely replace the wire, replace the item that the wire is attached to. The old equipment can be used in a boat or car—At least *they* won't self-destruct upon failure!

Obviously, with a bare wire, you're asking for trouble, so replace it. A broken wire isn't a total loss, as long as you're well versed in soldering. Just make sure that your repair is a high-quality joint and well insulated with heat-shrink tubing. Remember, you're only fooling yourself if you think you did a good job. . and didn't!

If you have a kinked wire, write it off. Copper wire can only flex so many times before snapping. A kink normally stresses the wire pretty badly, so assume that there's significant damage to the wire and repair or replace it.

How about that switch harness? Does it look clean, or does it look as if it's been dunked in the oily exhaust from the engine? If there are significant traces of oil *on* it, you can bet that there's oil *in* it, and that really isn't good for the switch. Again, when in doubt, throw it out. Even if there's no trace of oil, make sure that the switch works smoothly and reliably. A slight crunching sound means that dirt has made its way inside and will cause it to fail sometime soon. If it doesn't transfer power when thrown just once, that could mean worn-out contacts. It's best to replace it and so live to fly another day.

Frank Kelly of Las Vegas has that look of disgust as he faces an engine repair at the field.

Now to the servos. When they operate, do they sound smooth and quiet, just like new ones? If not, it will pay dividends to find out why they don't. Maybe it's time to clean the pot (potentiometer) or lube the gears. Have no fear, just jump right in there and do it. Make sure that the grommets are soft and pliable. These little parts have to absorb a fantastic amount of vibration from that fire-breathing engine up front. Heaven knows what kind of damage vibration would do to your servos if the grommets didn't stop it. These are really cheap to replace, so don't skimp here. Besides, they're great for leading the antenna out of the side of your plane when you want a clean-looking hole that won't cut the antenna.

Consider installing servos that suit your needs for pattern, if you have to replace them. Most servos you get with the radio system are standard-service servos. There's a difference in the performances of servos, and this will be directly reflected in the flight performance of the bird, especially in pattern. A faster servo means that the ship will respond to command more quickly and more crisply. Also, when you want that baby to stop rolling, it will certainly help to return the ailerons to neutral as fast as possible. There are other considerations to be taken into account in servo installation, such as centering, resolution, ball bearings, pot, etc. Speed is only one example of the benefits that a high-quality servo will provide.

Now inspect the connection from servos to flying surfaces. This normally means the pushrods and cables. Make sure that they're in good shape and not stressed or bent. I've seen pushrods which are bent beyond recognition, not always as a result of excessive flight loads. My book says the fewer bends there are, the more reliable the transfer of torque will be. So, whether the bent rods result from installation or flight load, keep them straight and true for maximum effect.

The same goes for the cables. Loose cables are asking for flutter—never seen flutter? Hang around pattern long enough, and you'll eventually see a fast bird

PATTERN MATTERS

Merle Hyde seems to be showing the troops his method of checking things on a Dash. Pre-flight checks are a vital part of safe, accident-free flying.

disintegrate before your very eyes from a flutter. Keep the cables taut and make sure that they're well-secured at the ends. No breaks, kinks or fraying allowed!

On the flying surfaces, the first check is the pull test. Give each flight surface a good tug to ensure that the hinges are holding. Time will break the bond of adhesives to wood and fiberglass. This problem will be compounded by hinge-pins, if you use that kind of hinge. Hinge-pins are pretty good, but the hinges they run through may be fatigued. If they don't look new, replace them.

The next test is of the control horn. Make sure that it's securely attached and has no play. Check the hole at the clevis connection to see if it has worn and is elongated. If it is, replace the horn. While you're at it, look at the clevis to make sure that it works as advertised. These are cheap to replace, and good ones go a long way towards ensuring safe flying. Personally, I like using ball joints because they are virtually slop-free. But, whatever your choice, just make sure that your clevis or ball-joint installation is textbook perfect and secure.

Now to the engine. If you did your homework, the mothball efforts you made last winter will ensure a well-preserved engine this spring. If the engine is well preserved—no problems. If the engine caught the rust bug—big problems. No use writing to Peter Chinn about your problem; just bite the bullet and repair or replace. As with my other preventive tips, you're only fooling yourself if you think you can get by without them.

Last, the airframe itself. We hope to have a clean bird that is a little dusty but proud and ready. Look for oil-soaked areas around the nose, tail, underside and especially at the hinge lines. Look at the floor beneath the bird. If there's a drop of oil there, then you probably have an oil-contaminated airframe. If there has been some contamination, hope that it's in an area that's not critical to airframe integrity. Critical areas are the fire wall and bulkhead joints, wing-mounting-block joints, any hinge line and any longitude-direction joint. If oil has worked its way into any of these spots, you'll probably have some type of structural failure there in the near future.

To cure this problem, remove the oil completely and repair the areas to at least original condition, if not better. Fire wall and bulkhead joints should be completely coated with an epoxy-type fuelproofer. External joints should be sealed with paint or covering material to prevent an oil invasion. As far as possible, hinge lines should be kept clean and oil-free. The wing-mounting blocks may have to be replaced if they're soaked with oil. Don't forget that oil makes wood expand, and if you have a nylon bolt running through it . . . makes you think, huh? (Not to mention the chance of the adhesive cutting loose.)

Go over the retracts, and check for proper operation in both directions. Here, I recommend the first operational test of the aircraft. Investigate any retract that seems to hang up or fails to lock down. For those using pneumatic retracts, it's time to lube the cylinders. After hanging around for a couple of months, the seals could probably use a little help getting back in shape. My method of lubing calls for petroleum jelly and about ten minutes of your time. Simply remove an air line from the retract and stuff it into the jelly, filling about one inch of the air line with jelly. Once this has been done, hook it back up to the cylinder and pressurize it. The high pressure will force the jelly into the cylinder and so lube the seals quite well.

In the second operational test, make sure that all flight surfaces move in the direction that the transmitter tells them to. I like to move the left and then the right aileron and to actually watch them move. This flight check may seem trivial, but it could save an aircraft someday. The reversing switches are very easy to forget. Make it a habit to flight-check before every flight, even if your previous flight was just ten minutes ago. Doing this, I guarantee that you'll trace at least one major problem each year that would have been fatal to the ship if it wasn't fixed before flying.

Before doing the last operation—taxi-testing—take a long, hard look at the tank and fuel lines. Replace old lines and then pressurize the tank slightly to ensure that there are no leaks. If this passes the test, fuel it up and see how it runs.

Although this check-out seems like something the *other* guy needs to do, you really ought to try it. In reality, only a small percentage of the readers who read this column will actually safety-check their birds. Of those who say that they don't need to, a higher percentage will suffer a "Class A" mishap due to some error or failure that could have been prevented by a systematic check-out. (A "Class A" mishap is one that involves the total loss of the aircraft.) If you do nothing else, at least get into the habit of performing the flight-check on taxi-out. Just make sure that all the surfaces are moving, and moving in the correct direction. You'll find that once you save one bird because you did that check, you'll be telling others to do it as well.

I received a letter from Rick Pellicciotti of Broken Arrow, OK, in which he says, "I'm familiar with turn-around-type flying, having been a member of the International Miniature Aerobatic Club (IMAC) for some years. That's the only type of flying (turn-around) they've ever done. I've noticed some contests with turn-around-type events in the lower categories, and I've enclosed a copy of the sequences that were flown in two contests that I know about."

Thanks for the input, Rick. For the record, here's the Sportsman-Class schedule that was flown by the Team Race R/C Club of Pearl, MS:

- Take-off.
- Enter box to three inside loops.
- Stall turn.
- Cuban 8; exit box.
- Enter box to one reverse outside loop.
- Half-reverse Cuban 8.

(Continued on page 103)

SIG MANUFACTURING

by WALLY ZOBER

IF YOU LIKE pretty airplanes and scale-type R/C model airplanes that fly like full-size airplanes, then the updated, redesigned Citabria kit by Sig Manufacturing Co.* will be your cup of tea.

Back in the late '60s, tail-draggers weren't popular as trainers and sport-flying aircraft. Champs and J-3 Cubs were being replaced by tricycle landing-gear aircraft such as the Cessna 150 and the Piper Tri-Pacer, etc. As the popularity of the Champs and Cubs declined, the Champion Aircraft Corp., who earlier purchased the design rights to the once-popular Champ, decided to take a gamble. One

Wally is smiling here, so we can only assume it must be the second flying day! See text.

CITABRIA AIRBATIC

Hold this page to the looking glass to discover the Citabria's past.

Redesigned, great aerobatic trainer.

SPECIFICATIONS

Type: *Sport Scale*
Wingspan: *69 inches*
Length: *47 inches*
Wing Area: *740 square inches*
Wing Loading: *25.7 ounces/square foot*
Weight: *8¼ pounds*
Recommended Engine: *.35 to .50, 2-stroke; .45 to .61, 4-stroke*

Photos by Wally Zober and Stu Richmond.

Above: *Conventional structure, materials we all recognize, classic model.*
Left: *From the length of that stride, Wally may have set the idle just a bit high!!*

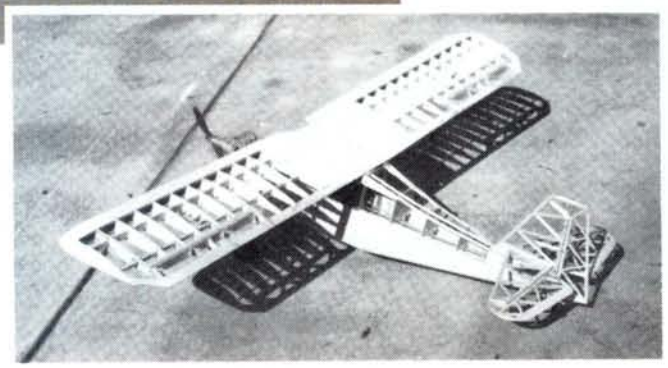
last attempt was to be made to save the Champ by redesigning it and making it an aerobatic trainer. Critical areas of the structure were beefed up, new spring-steel landing gears were added, and the rudder and wing tips were squared off. As a marketing gimmick, they spelled airbatic backwards, and came up with the new name, Citabria. A new airplane was born!

By the end of World War II, aerobatics had virtually disappeared in sport flying. However, the gamble that Champion Aircraft Corp. had taken paid off, and aerobatics was revitalized in sport aviation. The Citabria caught on and became very popular as an aerobatic trainer. Many of today's aerobatic pilots will tell you that their training started with the Citabria.

Designed by Maxey Hester, the Sig Citabria kit was first introduced to modelers in 1968. The original kit had a fully symmetrical airfoil that was great for aerobatics by a skilled pilot, but not much fun for the average Sunday flier. In 1972, the kit was re-released with several changes. The airfoil was changed from a fully symmetrical to a flat-bottom airfoil, which it still has today. The flat-bottom wing made the Citabria much easier to fly, yet it was still capable of doing scale aerobatic maneuvers.

At the time of the 1972 kit release, one important change *wasn't* made. The instructions for building and flying the model were still printed on the plans. Since that time, things have changed dramatically in the modeling industry. Kit builders today want details spelled out for them. They want clear step-by-step instructions and don't want to second-guess the designer of the kit. Sig Manufacturing isn't the type of company to be left at the post. They saw this trend and responded by becoming one of the first kit manufacturers to include a photo-illustrated instruction manual.

Left: *Just breaking ground, the Citabria climbs out smoothly.*
Below: *Lots of wood, substantial building, definitely NOT an ARF!*



The Citabria kit has now been around a long time, so Sig decided to update the kit. They came up with a new building and flying instruction manual, a new set of drawings, a new decal sheet, a new style of wheel pants, a new air scoop for the cowl and a formed tail-wheel wire assembly.

The plans are on two sheets: Sheet 1 shows the side view of the fuselage, plus the top view of the fuselage and the fin, rudder and tail-wheel assembly. It also shows all the bulkhead cross sections, cowl and landing-gear installation, plus the balance point. The balance point on

READER REPORTS!

MINI FIELD & BENCH

CITABRIA

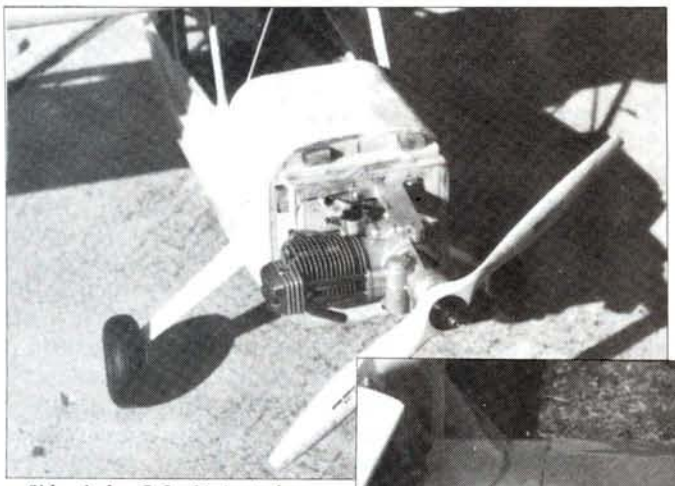
I'm making a Sig Citabria—my *second* attempt at building a model plane.

I have two main reasons for buying the Citabria: First, the plans and booklet provided by Sig are very complete and allow even an amateur like me to construct a pretty decent craft. Second, I figured the Citabria would look great on floats.

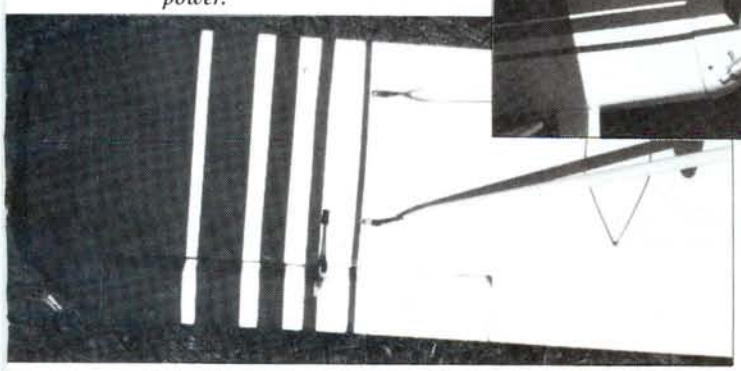
The supplied instructions are superb, and I don't see how they could be improved. There's very little left to your imagination; if you can't find the proper direction in the booklet, you can find it on the plans themselves. I was greatly impressed by the Sig Kadet Senior kit, which led me to the Citabria. The Citabria, being a more sophisticated aircraft, of course has more detailed instructions, but they're easy to follow, and I give the Citabria very high marks.

Three views of Joe's Sig Citabria under construction. His **second** *model!! Think he'll try an F-15 next?!*

Joe Feori, West Des Moines, IA



Sidewinder O.S. .61 4-stroke provides abundance of smooth, quiet power.



Above: *Plastic cowl neatly trimmed to provide engine clearance. No "muffler" pressure used.*

Left: Simple strut attachment and short, straight aileron pushrod shown here.

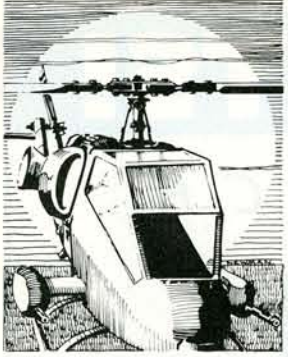
this airplane is most important, and I'll explain why when I describe the first flight. Sheet 2 shows the two wing panels and center wing section, the stabilizer and elevator, aileron and pushrod installation and wing struts. These drawings are very comprehensive.

The kit comes with die-cut balsa sheets, die-cut plywood, sawn plywood, balsa sheets for the leading and trailing edges, balsa sticks (longerons), blocks for fuselage, wing and empennage, hardware in plastic bags, bent-wire parts, aluminum landing gear, plastic parts, windshield, side windows, cowl, wheel pants, plans and instruction manual.

CONSTRUCTION: When I build a kit, I usually start with the wing, and that's how I started the Citabria. I'm not going to go into a step-by-step instruction, as the Sig manual does a great job with its photos and instructions. However, I'll point out areas where problems may occur.

- Wing construction. The instruction manual calls for and shows rib stacking for the purpose of removing high spots and burrs. Do it lightly, as excessive sanding may distort the airfoil shape. One minor problem was the shallow die-cutting on the wing ribs. I had to cut out almost all of the ribs, because the die didn't cut deeply enough. This didn't happen with any of the plywood die-cutting parts, as they popped out easily. When positioning wing ribs to wing

(Continued on page 103)



Helicopter Challe

by CRAIG HATH

THIS MONTH, I'LL skip the tutorial on setting up the ideal helicopter for all-around flying, and talk instead about a few items which are of interest to most R/C helicopter enthusiasts. First, I'll describe some of the new products that I discovered while recently visiting the IMS show in Pasadena, CA.

IMS Show

For starters, I wish that two of the gadgets I found there had been available when I was learning to fly. In fact, one of the items may still be good for polishing maneuvers or learning new maneuvers.

I think I've seen a good cross section of R/C training aids, but felt as if no one had really "invented the wheel," yet!—until I saw a neat device designed by Rock Whiteman, who owns Whiteman Industries* of Sunland, CA. Mr. Whiteman was faced with a dilemma that we've all come across: trying to keep a model flying long enough to learn how to fly, without constant lay-offs for repairs, waiting for parts, etc.

His solution was to devise a way to tether a helicopter to the ground without letting the tethering device hinder the flight characteristics of the hovering helicopter. The result of his efforts is being marketed as the Helicopter Flying Stand.

The Flying Stand will allow the helicopter to move in just about any direction without ever striking the ground. Blade strikes will be eliminated, as the rotor blades cannot touch any part of the stand or ground, regardless of the attitude of the helicopter. The Flying Stand will permit the model to fly in a seven-foot circle and reach up to four feet high. This is perfect for a novice in a small area, and it will enable him to master the controls of the machine, including stationary hovering up through nose-in flight. The price of the device will be less than the total price of parts needed to make repairs after two crashes, so the investment would be wise. For more information, contact Mr. Whiteman.

The second impressive item is a tool that could be used by any R/C pilot (rotary or fixed wing). Ambrosia Microcomputer products is about to release its new flight simulator for use on the Atari ST line of home computers. There are over 7,000 hours of development in this program, which has been written by modeler and professional programmer David Stern. With this program, you can set up the conditions for the model that you're flying and for the environment that you'll be flying in. You'll be able to select a type of aircraft, e.g., sailplane, sport airplane, pattern airplane, beginning-through-advanced helicopter and more! You may also choose the way the camera views the model, e.g., from a fixed point ten feet high, a moving "pan" set at ground level, etc. The possibilities are mind-boggling!

A close-up of Rock Whiteman's device. It won't allow rotor blades to touch any surface, including the ground.

If it sounds as though I'm excited by this product, it's because I am. Once I'd taken hold of the transmitter (this device takes the place of a joystick and is a production 4-channel transmitter modified to interface with the computer), I found myself standing there, adrenaline pumping through my veins as I lifted the machine into a hover, corrected for the wind drift, completed a four-point pirouette, dumped the nose and entered forward flight, looped twice, did a Belgian stall turn, slow-rolled to inverted, and reentered hover nose-in and inverted! You just lose track of the fact that you're not at the field with the real thing, but just sitting in front of a screen. The "model" flew so well that I caught myself preparing to ask David about the particulars of his setup, like pitch curves, rotor blades, etc.!

At any rate, if you have these last two items in your arsenal, you could become one of the local hot dogs in short order and probably never break a rotor blade in the process. These goodies aren't a substitute for the experience of unbridled

The GMP booth at the recent IMS show in Pasadena, CA.

The Morley Helicopters booth. This line is being imported from Great Britain, and it focuses on keeping the cost of the sport low.

Close-up of the new single-axle rotor head that will be available for the GMP shuttle. This will help make the ship more responsive and less prone to boom strikes.

flight, but they'll go a long way toward preparing you for that time.

Moving through the show, I had the opportunity to speak with Robert Gorham about the new things coming from Gorham Model Products* in 1988. New items include an upgraded Hirobo Shuttle that features a new single-axle rotor head to help eliminate boom strikes, a stronger set of main frames, a new tail-rotor casing, a simplified collective system and an upscale version, loaded with more ball bearings for precision hovering and longer service life. The Shuttle will still be shipped assembled, and '88 models will have a new body color. GMP is about to release a new rotor head for models in the .50 to .60 range; it's called the S/R, for Super Response rotor head. This head is designed to make cyclic response come alive, allowing aerobatic maneuvers to be performed with greater ease and predictability. One final new item from GMP is a "flybarless" rotor head for the Cobra and Competitor models. This head will be of particular interest to scale modelers.

Robert Gorham's Jet Ranger with the new S/R rotor head. S/R stands for "super response."

As well as all this, I had the opportunity to meet Tony Moreno at the show; he's the US representative for Morley Helicopters*. The thrust of Morley's line is to provide good flying models at reasonable prices. An example of this is the Augusta 109, which features a fiberglass body, full collective-pitch mechanics and retractable landing gear, all for under $400. That's a very reasonable price for any collective-pitch .40- to .45-size model, especially one with scale fuse included. The Augusta 109 is also the most expensive model in the line, which includes a Hughes 300 and a Bell Tow Cobra, both built around the Morley Mk 3 mechanics. A pod-and-boom version of this ship is also available.

One of the other items being handled by Morley is a gyro, which I think was the popular Quest gyro from Australia. Mr. Moreno claims that the gyro is very solid, and that it will give the flier full stick authority for aerobatics.

Circus Hobbies* introduced the O-mega, a new helicopter from Kalt. Much influence from former world champion Taya is evident in this design, e.g., the unique pull/pull cyclic controls, which have the servos placed behind the main shaft, and a new tail-rotor transmission to complement the design. In fact, this appears to be a strictly competition-oriented machine, but don't let that stop you. Couple the Omega with the new 10S rotor head and the Jet Stream body (designed for the Omega) and you have a world-beater!

Also of interest is an item from High Point Products* that will permit any rotor head to be balanced on the popular High Point balancer. The shaft will adapt to accommodate either 8mm or 10mm main-shaft rotor heads. The item isn't new, but it was new to me. High Point also has other interesting items for heli modelers. For one thing, if you don't have a "High Point," get one! This is the handiest tool for tracking down vibrations. You can balance just about anything that moves on the machine, e.g., tail-rotor systems, cooling fans, clutch assemblies, etc. There are adaptors to mount most spinning parts to the balancer. Check with High Point for more details.

A screen showing the helicopter portion of the R/C aircraft simulator from Ambrosia Microcomputer Products. The helicopter was very impressive, as it responded just as a model does.

New Helicopter Club

I learned recently about a group of fliers in the Pittsburg area which has formed a new club strictly for R/C helicopter owners. The name of the club is the Pittsburgh Area Rotor Runners Helicopter Club*; membership is open to anyone and dues are $15. The group is planning a fun-fly event, to be held on May 14 and 15. They have plans to move activities to different locations in the area, so making it more convenient for participants to attend. Call or write for more information.

Heli Interests

I'm always encouraged when I hear of a group forming to disseminate information about our hobby. As I've mentioned earlier, we're one of the few groups in R/C that doesn't have a *national* special-interest group to represent us. I feel that there are enough helicopter fliers to make this worthwhile, and I hope that my feelings are shared. If you agree with me on this issue, please let me know, and

we'll work to get things started. Further, if you're a member of a helicopter-oriented club, please send me information about your group and your activities so that I can mention them in this column. You can keep me abreast of the group's activities by mailing me a newsletter, or copies of any event fliers, etc.

XCELL Upgrade

If you own one of the fine new XCELL helicopters from Miniature Aircraft U.S.A.*, you'll be interested to know that the helicopter has been modified to make it even more reliable. Seven changes have been incorporated into all new production kits, and parts will be available if you want to upgrade existing models. The changes are:

- New CG-corrected rotor blades that utilize the new blade mounts, which will withstand 4,000 pounds of pull.
- Specially treated tail output shaft (No. 0429) and special studs (No. 0459). These parts will ensure greater resistance to damage from hard landings.
- A smoother, quieter compound for the main gear (No. 0207) is being used; this eases the setting of the gear mesh.
- High-strength bolts for the main rotor blades (No. 0083) to complement the new rotor blades, and give greater blade security in the face of a trend toward heavier blades at higher rotor speeds. (Miniature Aircraft still recommends that the rotor speed be set between 1,600 and 1,650rpm for hover, as this seems to give optimum performance.)
- All clutch bells (No. 0277) and fan hubs (No. 0257) will have knurled contact surfaces for 100 percent clutch/fan contact.
- A new landing-gear strut is claimed to give 25 percent more resistance to damage from hard landings.
- A new, improved canopy material will make the completed unit stronger and easier to paint.

Miniature Aircraft warned us to be on the lookout for black-market parts for the XCELL line of helicopters. Use of substandard replacement parts may initially save money, but the parts probably won't last long and may even fail at the most inopportune time, so resulting in costly damage far outweighing any initial savings.

That's it for now. Next month, we'll resume our discussion on trimming, and we'll pick up on the setting of collective pitch curves and related items. See you then!

**Here are the addresses of the companies mentioned in this article:*

Whiteman Ind., 10826 Nassau, Sunland, CA 91040.

Gorham Model Products, 23961 Craftsman Rd., Calabasas, CA 91302.

Morley Helicopters, R/C Models USA, P.O. Box 6026, San Pedro, CA 90734.

Circus Hobbies, 3132 S. Highland Dr., Las Vegas, NV 89109.

High Point Products, 3013 Mary Kay Ln., Glenview, IL 60025.

Pittsburgh Area Rotor Runners Helicopter Club, c/o 227 East Main St., Carnegie, PA 15106. Tel: (412) 921-0554.

Miniature Aircraft USA, 2324 North Orange Blossom Trail, Orlando, FL 32804.

AEROBATIC SPECIAL

1988 UNITED STATES

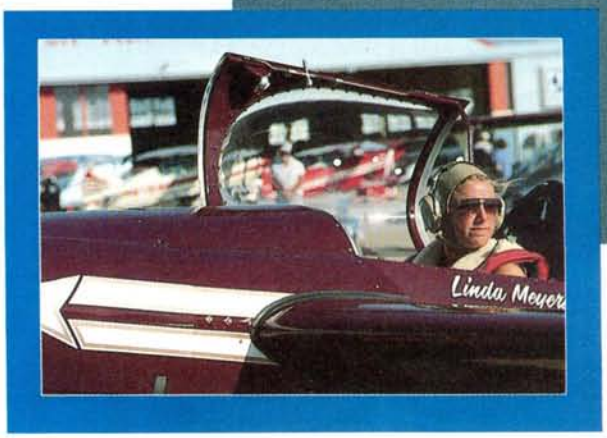
WHILE MUCH OF the world was focused on the thrills and spills of the 1988 Winter Olympics, others were getting ready for yet another international contest. Olympic events see athletes competing in very earthly pursuits, but a more flighty breed are readying for something far more celestial in the skies over Red Deer, Alberta, Canada.

The good old US of A didn't do so well in Calgary, but our aeronautic competition prospects are far better in Red Deer, where the US Aerobatic team is expected to bring home the bacon—and the smart money is quite emphatic about that!

If you knew what qualified these pilots for such an honor, you'd hardly be able to disagree. It all starts each September in northern Texas...

This year's National Aerobatic Championships in Sherman/Denison, TX, was a rather exceptional affair. The skies were clear and blue, the winds manageable, the pilot participation high, and the level of competition was the fiercest ever seen in a US National Aerobatic meet. What a week!

Intense concentration, psyching up, getting ready to give one's all...



The rapid growth in popularity of sport aerobatics has been accelerating of late—so much so that the Unlimited competition at this year's Nationals had the largest field of competitors that anyone could remember. People from all walks of life

AEROBATIC hampionship Team

by JIM CAMPBELL

Two-time US Champion, Clint McHenry, forms up over Sherman, TX, with top flier, Patty Wagstaff in close formation with her Extra 230.

gathered to carve up the sky with precision, strength, ingenuity and determination. There were doctors, business people, salespeople, students, lawyers, flight instructors, technicians and more than a few airline pilots interested in getting away from their usual flying buses. Even more interesting was the fact that a record number of women showed up to do battle. While the oldest competitor was approaching his mid-60s, the youngest was 17-year-old Sheila Johnson, who flew a Pitts S-1T.

As the traditional site of the US Nationals, Sherman/Denison is ideally suited to the event. Even better, you'd be hard-pressed to find a more cooperative atmosphere and staff than those

Clint McHenry leads a pair of Pitts, just after breaking ground. Monoplanes and biples find equal favor among aero pilots. Note variations in Pitts' gear and rudder shapes.

found here. A former military base, this large, expansive airfield has only moderate traffic, a very open-minded tower staff and an ideal layout for the judging of an aerobatic event (a critical consideration). Modern competitive aerobatics are far more than a bunch of pilots trying to outdo one another; it's a highly disciplined, carefully organized activity where the *rules* are at the heart of every move.

For instance, it's not a simple matter of trying to do each maneuver where the judge can see you...Oh, no. You have to accomplish your objective within a very well-defined set of boundaries. There are several judges stationed at these boundaries, and their sole mission is to ensure that each competitor stays within the limits. Besides increasing difficulty, the primary reason for the boundary is to ensure that the judges have a good view of the pilot. This limit is set up to ensure the safety of all, and this has made the US National Aerobatic Championships one of the safest sporting events in the world. Honest!

Think of it ... there you are, looping, spinning, rolling and blasting your way through the sky while trying to execute each maneuver as precisely as possible. All the while, you're also responsible for keeping your sweaty self within the confines of a "box" that measures 1,000 meters (about 3,300 feet) wide, 1,000 meters long, has its lower limit more than 328 feet off the ground and is less than 3,500 feet high at max altitude. Exit the confines of this box and lose points, screw up a maneuver and lose points, do a maneuver out of sequence and lose points, fail to follow the entrance and exit procedures and lose points—it's a wonder that anyone can score at all! All this occurs while you're trying to wrestle a 200-to 300hp airplane around the

Gorgeous Pitts taxies past one of Uncle's Holloman-based Eagles. Needless to say, they're both aerobatic, but the F-15 needs a larger "box."

(Continued on page 60)

On the ground, countless hours are spent in thought, flying imaginary maneuvers, with one's hands and arms substituting for the aircraft.

The eternal quest for weight loss often leaves these aircraft without the luxury of an electrical system and starter...hence the "Armstrong" start.

Patty Wagstaff competed in her new Extra 230 monoplane after only six weeks of practice with her new bird.

Long-time team member, Henry Haigh, gets ready to head up for his four-minute Free program.

Clint McHenry helps a fellow competitor to move an aircraft into position after the contest.

PEOPLE FROM ALL WALKS OF LIFE GATHERED TO CARVE UP THE SKY...

(Continued from page 58)

sky and fighting the vagaries of wind, turbulence and your own nerves. This isn't a pursuit for the insecure!

You don't compete in the US Nationals just because you want to. Both pilot and aircraft have to prove their competence and ability to undertake such a challenging endeavor. Before the first flight, mechanics and safety inspectors check each aircraft, its systems and all the required documentation. Administrative personnel check each pilot's license, FAA waivers (for low-level flight), medical certificate and history, competition record, insurance and other matters before allowing them to fly.

Speaking of medical matters, think of those loops you may have learned a while back, or those spins you suffered through a few years ago, and then consider the rigors of Unlimited aerobatics. A few seconds at 3 or 4 Gs is probably a big deal to the average pilot, but consider the torture of a contest where you're forced to undergo the prolonged physical onslaught of 6 or 7 Gs—positive and negative! All this, while trying to do each maneuver with the kind of precision that can be ruined by an error of only a few degrees, or a second of mis-timing. Each pilot professes to love the challenge, but their fatigued faces on landing also speak eloquently of the punishment of high-performance Unlimited flying.

Such a competition is judged by dozens of professionals. There are judges who verify that you stay in the box, judges who verify your procedures, and judges who score the maneuvers—each usually accompanied by one or two assistants. If you screw up, there are plenty of well-trained eyes to catch it.

Judges have to undergo a period of training, apprentice for an appreciable time and then qualify at basic levels before finally working their way up the ladder to the US Nationals. Each judge has to follow a careful set of rules and guidelines that are detailed in the International Aerobatic Club's "Official Contest Rules." The judges themselves are checked and graded according to pre-calculated scoring biases via a complicated international scoring system that reflects the current stats in world competition. If all that isn't good enough, each pilot has the right to protest a judge's decision. This will then be arbitrated by an aerobatic "jury" as soon as circumstances allow it.

The maneuvers flown by Unlimited-class competitors are complex and demanding; they require the very best from the combination of pilot and aircraft. If either isn't absolutely up to par, there's literally no way to win

(Continued on page 105)

SUPERBLY FINISHED, GREAT-FLYING SPORT-SCALE ARF.

AIR CHAMP MODELS, INC.

TUCANO

by FRANK TIANO

A WHILE BACK, I showed you what it was like to visit beautiful Costa Rica and to participate in its "Fun in the Sun" annual get-together and fun-fly. If you really read every word in *MAN*, you may recall that Julio Pastora, the organizer of this prestigious event, demonstrated an absolutely wonderful RTF (Ready-To-Fly) Tucano that he'd taken delivery of only the night before his demonstration. Well, that Tucano is the subject of this review. No, I didn't grab Julio's; I simply

Superb finish is paint, not film!! Canopy is easily removed to add a pilot or two. Radio, engine, prop and spinner are the only additions required.

Webra .40, 10x7 Rev-Up prop and K&B 1000 fuel provide 100+mph flying!! Flies super when balanced properly.

drove 18 miles to Miami and picked one up for myself!

Air Champ Models Inc.* imports the Tucano from one of its factories in Brazil. They sell the model direct to U.S. consumers for a nickel less than $275.

"Tell me more," you beg! Well, Air Champ brings the models into Miami from Brazil, gives them a thorough checking over for defects, then puts the parts into a big padded box and ships them to greedy U.S. modelers who scoop them up, because they know a good deal when they see one.

CONSTRUCTION: With very few parts to join together, construction is quick and very easy. In the case of the Tucano, "What you see is what you get" has never been more true. It took longer to install the Futaba* radio than to assemble the few pieces. Three hours from the box to the runway! When you open the box and tilt it downwards, two large pieces and one small piece fall out, and that's it! I thought they'd forgotten the other 75 percent of the kit, but not so—that's the total! The three parts were one fuselage, one wing and a parts bag. The fuselage is constructed of fiberglass and the wing

Tucano comes out of the box this way! Surfaces are pre-hinged, linkages installed.

and stab are foam units pre-covered in a lightweight sheeting and then fiberglassed. The servo mounts, engine mount, fuel tank, landing gear, pushrods, foam padding and all hinges are already installed. The special RFM motor mount permits the use of many different engines without drilling and tapping holes. And, best of all, it's already fuelproofed and painted in red and white with all decals applied.

The kit comes with a very sparse booklet that outlines the nine construction steps. The booklet also gives the Tucano's dimensions, but accuracy was lost somewhere in the translation from metric to American, because they're entirely wrong. I'll give you the *real* stats: a wingspan of 55.5 inches, a 556 square-inch area and a calculated wing loading of 27 ounces per square foot. The Tucano is 45 inches long, has a symmetrical airfoil and a larger-than-scale stab for increased stability and better aerobatics. You can expect a finished weight of 6.25 pounds plus an additional 6 ounces of nose weight. I thoughtfully figured this into the wing loading for you.

The booklet leads you to believe that the Tucano won't need any nose weight, but the CG fairy says otherwise. If you'd like to make it past the first left turn, I strongly suggest adding 6 ounces. Other than a couple of minor snags, the model is a real blast to fly. And, of course, it looks so good that you may be tempted to tell everyone that you painted it all by yourself! That way, you can feel like a real Steve Stunning type... until this issue hits the stands!

"Hold on," you say. "What's this about a couple of snags in this here pretty aeroplane?" Well, the nice motor mount that's supposed to fit every known .40 just doesn't fit. You must use one of the narrower-girth .40s to fit within the mount. A big fat Rossi won't make it. While you're at it, add two or three degrees of downthrust to the motor mount. This stops the hunting tendency the Tucano exhibits during quick throttle changes. A little tape or some other sealing method for the ailerons is a big help in getting more roll response. Why not make the nose-gear steering cable take a direct route to the steering arm and adjust the throw for the absolute minimum? This will allow the Tucano to remain tractable during its takeoff roll. And last, but certainly not least, remove the fuel tank, take off the ugly black tubing that they've so thoughtfully welded to the pickup tubes, and replace the whole mess with your favorite U.S. brand of tubing (something like Aerotrend's* Blueline). While you're at it, re-label the lines, since they're incorrect as provided.

I enjoyed building the Tucano, even though it did take two hours and 45 minutes out of my day. I rate the ship about an 8.3 on a scale of one to ten. The only reason I can't give it a perfect score is that I prefer military paint schemes and think retractable gear would enhance the appearance and performance. However, I must admit that the striking red-and-white paint job certainly did get its share of "oohs" and "ahhs"

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JET BLAST SPECIAL

Photo: Wally Zober

TANGERINE TOP GUN

GUEST COLUMNIST: WALLY ZOBER

DUCTED-FAN FLYING is alive and well in central Florida! After moving from New York to Florida, I joined a prestigious R/C club called The Remote Control Association of Central Florida (RCACF). This club is known worldwide, as for 20 years they've been the hosts of the world's largest independent radio-control competition—the Tangerine International R/C Championship.

This year, they added something new: a Ducted-Fan Fly-in with competitive events. I was asked by the club's Board of Directors to C.D. this new event; I accepted and enjoyed the job.

It was decided that the Ducted-Fan Fly would be a two-day event and that it would be held at the Deland Golden Hawks R/C flying field. What a super deal this club has! Their flying field is an abandoned concrete runway at the Deland County Airport (just perfect for jets). The R/C clubs in Florida are very cooperative in sharing their flying fields for special events.

On December 28, '87, the day before the Fan-Fly event, Bob Violett,

Photo: Alex Sim

Above: *One of the Byron Bullets flown by the Cloud Dancers Show Team; they also fly F-15s.*
Right: *The 1987 "top gun," Ron Gilman, with his Thunderbird-marked Violett Aggressor.*

Photos: Drew Telford

Some of the participants in the 1987 Jet Competition. This event is definitely on the upswing.

Dick Clayson, Ed Eldridge and yours truly went to the Deland Golden Hawks' field for a final test of the electronic equipment we'd be using for the Top Gun speed-trap event. The temperature was 82 degrees. (Boy, am I glad I moved to Florida!)

The two-day event was organized as follows: The first day was set aside for fun-flying and for trimming out airplanes and engines. This was done for contestants who had to adjust their aircraft to climate and temperature changes. We had contestants from Canada, Ohio, Pennsylvania, South Carolina, Maryland, Texas, California, Washington DC, and New York. This day also gave fliers a chance to see old friends, make new ones, and engage in "hangar talk." On the first day of the fan-fly, the temperature was a brisk 38 degrees, winds gusted to 25 knots, and skies were overcast. By 10 a.m., the temperature had climbed to 55 degrees, the clouds began to break, and the fun began.

The second day was divided into fun-flying and competition events. We had a good turnout for this two-day Ducted-Fan Fly-in: 22 paid registrants with 28 magnificent models. Bob Violett Models* dominated this Fly-in with 16 models, including: Sport Sharks, Aggressors and Vipers.

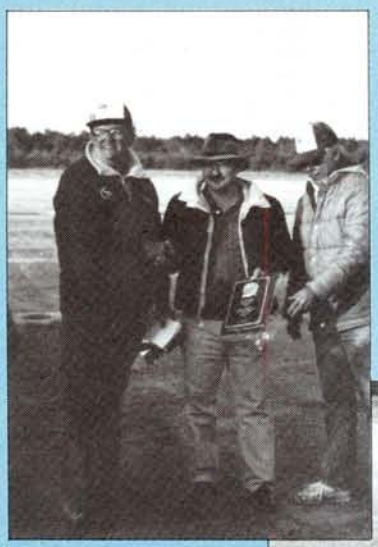
Byron Originals* was well represented with two F-15s, two new Byron Bullets, one KFIR and one BD-5J. Dave Nicholson had two beautifully finished Jet Hangar Hobbies* models: an A-4 Skyhawk powered by a Rossi 65 and a Dynamax Fan, and an F-86 Sabre powered by a Bob Violett fan and engine. Dave also had his Midwest Products* Heinkel HE 162—a Nick Ziroli design powered by a Rossi 65 and Dynamax fan.

Bob Fiorenze had a very impressive giant-size F/A-18 Hornet with a super finish, and an F-5 fighter in an Aggressor Squadron camouflage paint scheme (Yellow Aircraft* prototype).

We had an original design of an F-4 Phantom, designed and built by Eric Baugher. The powerplant for this model was a Jet Model Products* Dynamax fan combined with an O.S. 77. The model had a great finish, it flew well and was shown in the September '87 issue of *Flying Models* magazine.

It was a wonderful two days of flying—a chance to show off one's flying skills as well as craftsmanship. There were no ugly or poorly built models at this meet, so the "static" judges didn't have an easy task in selecting the "Best Finish" winner. Dave Latsha won this event with his gorgeous orange-, purple-and white-striped Viper.

There was plenty of time for fun-flying and hot-dogging. Bob Fiorenze put on quite a show with his giant twin-engine F/A-18 Hornet. His high-speed inverted passes, just six feet above the runway, had the spectators holding their breath. His F/A-18 and F-5 flying was extremely



C.D. Wally Zober presents Louis Levine with his well-deserved third-place Jet Pattern award.

Dave Latsha with his Viper and "Best Finish" award. Striking scheme of orange, purple and white.

Kathy Telford and Patty Violett with Patty's Viper. Watch out, guys! Patty took first place in Sportsperson Jet Pattern.

realistic and scale-like. He won Pilots' Choice for Most Realistic Scale Flight and Best Scale Model.

Bob Violett demonstrated the speed envelope of his beautiful model, the Viper. He did high-speed and low-speed runs through the speed trap and, during one unofficial flight, he clocked 176.6mph (fast speed) and 48.5mph (slow speed). Spectacular! He also dazzled the crowd with high-speed fly-bys and vertical climbs that took him straight up and out of sight. Bob does his homework, and it pays off.

Dave Nicholson with his air force; JHH A-4 and F-86, plus a Midwest Heinkel.

Tom Velosky and Don Muddiman, who are members of the Cloud Dancers Show Team, put on a super demonstration with their Byron F-15s and exhibited some great formation flying with the new Bullets—a Blue Angels-style program of high-speed head-on passes, and a half-roll into knife-edge just before passing.

Bill Williamson flew Dave Nicholson's F-86. In the Top Gun event, he clocked a 133.03mph fast time and a 60.78mph slow time. This model doesn't have inlet ducting; it uses a cheater hole. If he had inlet ducting and eliminated the cheater hole, his model would have flown much faster.

Photos: Drew Telford

Norm Holland flew a Byron BD-5J Coors Silver Bullet. He had a scary moment when, because of 25-knot gusts, he got caught at great distance downwind. Norm was at that point of no return, where you can't tell if the model is coming at you or going away, but he skillfully brought his model back safely, to an appreciative roar from the crowd!

Ron Shafer wasn't as lucky. Ron is an excellent pilot, and he was flying a faster airplane than Norm Holland had—a swept-fin Sport Shark. He got caught in the same predicament as Norm, but ended his flight in a spectacular crash, so losing a beautiful model.

Craig Wilson was preparing to fly his Violett Sport Shark, but while taxiing to takeoff position, his retracts drew in and his plane dropped its belly. There was no damage to the airplane (just to his pride!), and Craig found he had a transmitter problem.

Eric Baugher did a fantastic job of flying a scratch-built F-4 Phantom, which is his original design. His model had a top speed of 143.15mph and a low speed of 48.67mph. He scored high points in maneuvers and static, but lost out on vertical rolls and takeoff.

Now to the meat of this Fly-in: the Jet Pattern events. In the Ducted-Fan categories, Jet Pattern (Champion Class) was won by Ron Gilman of California with his Aggressor. Second place went to Bob Violett and his Viper, and third place went to Terry Nitch, who was also flying an Aggressor. This event was top-notch flying.

The second event, Jet Pattern (Sportsman Class) was taken by Patty Violett, who ran off with *all* the marbles. What a flier! Second place went to Greg Garneau, from Quebec, Canada, and third place went to Louis Levine. All three flew Violett Jets, and their scores were separated by only a few points.

The Top Gun event is the event everyone was waiting for. The tasks for this event are as follows: First, Static judging, which was based on workmanship and beauty (a la Formula 1). The goal was to keep the quality of models high. Second, noise-level control, and third, maneuvers, i.e., shortest takeoff, lowest speed, most vertical rolls, three free-style maneuvers, a high-speed run,

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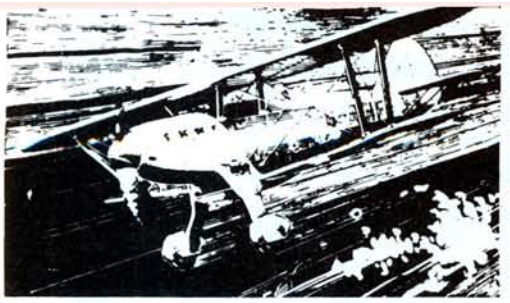
Upper left: *Bob Fiorenze's impressive F/A-18 Hornet; "Best Scale Model" award.*
Center: *Violett Aggressor; one of many on hand.*
Above: *Craig Wilson's Sport Shark suffered uncommanded gear retraction... no damage, fortunately!*



Golden Age of

by HAL "PAPPY" DeBOLT

HAVING ALREADY WRITTEN about Harvey Tomasian and his Live Wire "Senior," I thought there was nothing left to say. However, as often happens, reader input encourages me to raise the topic again. This time, it was Harvey himself who sent me a tape describing the Senior's exploits.

As the first Live Wire kit, the model is of historical significance. Harvey has an ongoing disagreement with Leon Shulman about whose Senior was actually *the first*. Harvey says that a letter came with his, describing it as the first of 12 kit prototypes. Leon dropped by the shop around noon on the day the Seniors were shipped, and Harvey's kit had been shipped that morning. Wouldn't you say that both can claim to have the first Senior?

Harvey's tape describes the protracted life of this model, which has been flown for over 32 years right up to modern times. That alone makes it a real gem. Add to this its association with three of R/C's best-known pioneers, and its place in R/C history is assured.

Harvey Thomasian's No. 1 Live Wire Senior. After 32 years of pioneer flying, it now resides in the Sherman Model Museum, Plymouth, NH.

The Senior was first flown with the K&B .19 and McNabb 465 single-channel radio, which were popular at that time. When Harvey launched his with the *switch off*, it flew away over the New England forests, but was found soon afterward on a game preserve and returned to him.

A happy Bill Northrop with his altitude-record-setting Foo-Too model, Quadraplex-controlled.

Many flights later, Harvey became interested in multi-reeds and Bramco. A date was made to meet Dick Branstner half-way at Buffalo, where an early Flying Bison meet was scheduled. The Senior graduated to multi-channel with Bramco and was test-flown the next day—the reed era had begun!

In the mid '50s, Bramco decided to forego R/C to manufacture televisions, etc., and there was concern about the loss of their fine R/C equipment. Harvey and Lee Renaud decided to try to continue Bramco production and purchased some of the remaining inventory. The two went into low-key production and offered an improved hand-held transmitter, which used micro-switches with the stick controls in place of the slow-acting toggle switches. Harvey says that the faster stick action helped him improve his contest performances.

These two enthusiasts were intrigued by the new Johnson .36 engine that featured the then-radical "Automix" carburetor. This was the first carb to feature a sliding valve, but naturally, the engine had to prove its worth in the Senior.

Apparently, Lee Renaud traveled about 50 miles several times a week to use the Senior and to learn how to fly powered R/C planes. The radio equipment was given the name "Airtronics," and Lee retained the name for his now well-known California operation.

Another R/C pioneer is Bob Elliott. As time went on, Bob did some fine things in California and Texas, but, like Lee Renaud, he got his start in New England. Bob had been making some reed equipment when proportional was in the seed stage. Being a visionary, Bob turned to propo and developed a system. When it was time to test it, Bob turned to Harvey and to the Senior. The Senior flights revealed some shortcomings (usual at that time) and it was back to the drawing board. However, out of all this finally came the "Logictrol," which was also tested in the Senior. The plane flew for many years with Bob Elliott's Logictrol.

Harvey's Senior wasn't one of those OTers which flew for a while and then gathered dust in storage. Instead, it flew

thousands of flights, wearing out many engines and radios. It trained untold numbers of pilots, and in later years it's often seen as a good example of OT R/C at contemporary flying fields.

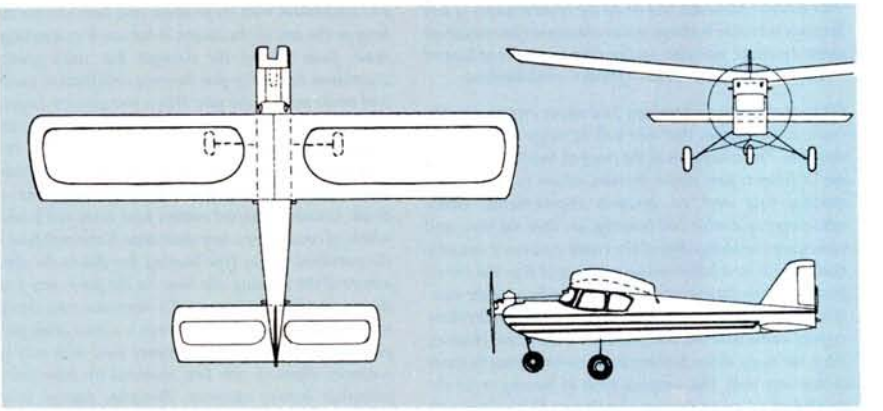
Its final flights were made at the 1982 S.A.M. National Championships, where a number of OT R/Cers had a hand at the stick.

A decision to retire the Senior was made at this meet. Harvey delivered it to the Sherman Model Museum in Plymouth, NH, where it rests today, resplendent in all its glory!

You readers help a lot with information. The mail brought an interesting letter and a three-view from Tom Ailes of Valparaiso, IN, so I can tell you of another outstanding man and his model.

Orbit Electronics and its equipment was the elite of R/C in the late '50s and the '60s. Orbit began as a garage operation with an outstanding single-channel system, just as most of the major manufacturers did. In time, their "black box" reed systems were flown by the world's premier R/C pilots. Later, the Orbit analog proportional came to dominate the scene, followed by a well-accepted digital system. Orbit's greatest asset was its customer relations. Throughout its history,

The Quadraplex first commercial proportional system was multi-pulse and used Bellamatic servos.



Milt Boone's rudder-only Charger set the pace for single-channel competition. Great kit, later offered by Ambroid, the glue people.

an inquiry from *any* modeler received top-level attention. The name of Bob Dunham is synonymous with that of Orbit, and Milt Boone was the "chief honcho" (Dunham's "do-it guy," shop supervisor—you name it!). Milt oversaw production and ensured that their quality was tops. Bob once said that Milt Boon *was* Orbit. Hope you get the picture.

There was one model design that brought Milt Boone national attention. In the days of "rudder only," his "Charger" design showed the way to contest-winning single-channel performance. As the three-view shows, this was another box-style structural design, but the aerodynamics facilitated an exceptional performance! In that day, the popular designs could be labeled "trainer types"; rather large for the power used, they were more like powered gliders. As such, simply adding power for improved aerobatics didn't suit the aerodynamics well. They needed to be *designed* for maneuverability. Milt showed how to do that with his Charger. First, with a .15 for power, the Charger was actually smaller than most .09 designs. Milt realized that extra power was needed for aerobatics. Additionally, with the use of a symmetrical airfoil in the stabilizer, the angular difference between the wing and the tail was kept to a minimum. This reduced the roller-coaster aftereffect from speed increases in maneuver recoveries. Takeoffs and landings were important point earners in the single-channel competition schedule. The tricycle landing gear was unique at that time, and could ensure a score of 10 for those maneuvers. Note that the fixed nose gear included considerable "caster," which facilitated straight ground runs. The combination made an excellent contest flier.

The Charger was built and flown all over the U.S. Like many other fine early designs, it was featured in a magazine (perhaps *American Modeler* or *Air Trails*). There's also some evidence that it was kitted, but this probably came too late for wide acceptance, due to the rapid switch to multi-controls. *(Editor's note: Sure was kitted... by Ambroid; I have a kit in my collection!)*

Continuing our proportional history, Don Brown was probably the first to offer a commercial propo system. A most likeable man, Don was from New Jersey. My info on the Dee Bee equipment is very sparse, but I do know that Don used the brand name "Quadraplex" for his offerings. Apparently, Model 21 was the first to be released, and this was multi-proportional: in this case, three full propo controls plus one trimmable (for engine).

If you recall the discussion about Bellamatic pulse servos, the Quadraplex 21 was developed to make full use of these excellent units. Of course, the Bellamatic required a pulsed signal with "on" instead of "off" time determining the output position. Thus, for three proportional controls there had to be three *separate* pulsed signals. This was accomplished with three distinct audio tones sent over a common carrier.

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duke's mixture

This month's discussion will be on the relative merits of ball bearings vs bronze bushings vs cast aluminum for crankshaft main bearings; and also on the relative merits of lapped — ring — and A.B.C. piston cylinder combinations.

First; on crankshaft bearings: Just about everyone in the trade acknowledges that two ball bearings are the most desirable. The advantages of the two ball bearing crankshaft are as follows: Low initial friction, which in turn makes starting easy and no break-in requirements. Other advantages of double ball bearings are that the wear and consequent resulting shift of the crank position is virtually non existent in a ball bearing motor, and that the thrust from a starter doesn't cause wear on the front of the case. If it were not for the cost, I think that all model airplane engines would have two ball bearings on the main. However, this is not to say that a bushing main motor cannot be made to run very well. The simplest form of bearing is for the crankshaft to run in the cast aluminum. This is done with fair success in our low priced 15 RC, and with the low priced K & B motors. This is simple and cheap. However, when the shaft runs in aluminum, it is imperative for it to be well lubricated. And therein, often, is a problem. If you make the fit a little too tight, and the fuel doesn't work its way out around the front, the bearing goes dry. At the best the motor slows down when you try to lean it out. At the worst, the crankshaft can gall and pick up metal, and ruin the crankcase. Also, assuming the motor does get a good start in life, it does wear. As it wears, you get more and more leakage out the front. A badly worn bushing can spray as much fuel out the front as it burns. Of course, this means that instead of flying 12 or 13 minutes on 8 oz. of fuel, you are out in 6 or 7 minutes. Also, carburetors don't work right when a bearing leaks badly, and a reliable idle becomes unreliable. The use of the hypereutectic alloys for main bearings reduce wear somewhat. But, in my opinion, it only alters it slightly.

Now, let's consider bronze bushings. True bronze is mostly copper with small amounts of alloying agents. #660 is the most widely used and works well. This has the advantage over aluminum in that should the shaft run dry, or when a little dirt gets in it, the galling does not occur like it would with aluminum. The manufacturer can then be less fearful of a dry bearing and fit it closer than he would an aluminum one. Result — Improved fuel mileage and better carburetion. While it is generally considered that the piston and cylinder present the primary break-in problem, this is not necessarily so. Bushing type motors do have the requirement of wearing in and polishing both the crankshaft and the main bearing surface. If the bearing is not honed just right, and the crank is not real round, it is quite possible to never get a really free running bearing. Some motors have appeared on the market which had rather yellow looking bearings, which signify high zinc content. These don't seem to work well at all. They tend to deform under the pressure of running, and the bearing gets loose. True bronze has a dark reddish copper looking surface, and not the bright yellow that you associate with brass. At this point I would also say that many manufacturers, including me, have at one time along the line tried the use of powdered metal type bearings. This type of bearing works poorly in model motors, presumably because the pores allow the oil film, which the shaft should ride on, to be pushed through the pores. Consequently, instead of floating on a wedge of oil, the crank actually rubs metal to metal. Powdered metal bearings will invariably wear the crank out much faster than a solid bronze bushing. The powdered metal bearings are cheaper. Whether they are better than the cast aluminum in my mind is questionable. The cast aluminum bearing does hold the oil wedge and the crankshaft will spin freer than it will in a powdered metal bushing. But, the steel crank against aluminum is vulnerable to wear and is very vulnerable to galling if a speck of dirt gets in the bearing or it runs dry.

Now, to the connecting rod. Connecting rods usually fail differently on the bottom end than on the top end. The bottom end is well cooled with the incoming fuel spray and is well lubricated. But the crankpin rotation plus its small size gives a pretty fair load rating, much higher than on a crankshaft. The unit load rating on a crankpin might be ten times as high as on a crank main. Connecting rods lower end are sometimes run on the rod material, and sometimes bushed. And, in rare cases, as in our old 60 and 74, and larger chain saw motors, have needle bearings. Aluminum rod material seems to run pretty satisfactorily on smaller size engines. In 19's and 25's, you can usually run aluminum with no problem and have the rod last as long as the rest of the motor. A bar stock connecting rod made from one of the stronger bar stock grades of aluminum has pretty fair bearing anti-friction qualities, and works well on the pin. When you get into larger size motors, such as 40's and larger, the wear rate on the connecting rod sometimes becomes unacceptable. In this case, most manufacturers have resorted to a bushing. However, in my opinion, a poor bushing is worse than none at all. Certain imported motors have brass rod bushings, which, of course, last a very short time. Some rods have used the powdered bronze type bearing, but due to the abrasive nature of the bushing, the wear on the pin is very fast. In short order, the crankpin itself is worn out, even though it is hardened very hard. #660 bronze is a good grade general purpose bronze, and is sometimes used with very good successes. However, the best material we have found is phosphor bronze material. Phosphor bronze is quite expensive, costing several times that of #660, but it is dense and very high strength, and has all the good characteristics of bearing bronze.

Now to the top side of the rod. The top side of a rod is not subjected to the high rotational speeds that the bottom is, since it only oscillates. However the lubrication conditions are much worse. The area is a whole lot hotter, and there is relatively small amount of fuel spray up in this area, and traditionally the size of the wrist pin is smaller than the crankpin. This is basically in an effort to keep the reciprocating parts light. However, the strain on a rod is considerable, especially in A.B.C. set-ups when the piston sometimes sticks. In a bad warmup situation loads can be high enough to pull the rod apart. In our experience, there is about an even choice whether we bush the top end of the con rod and increase its anti-friction characteristics, or whether we leave the additional metal around to increase the tension load that a rod can take in the case of a piston sticking. The choice seems to be dictated mostly by the type of failures that we have had, although I will have to admit that we do sometimes put a bushing in where it is not needed because people think that it means quality.

Now, to the piston and cylinder. For years the most popular model airplane piston materials were iron in its various forms, (gray cast, ductile, and mehanite). The advantage of an iron piston is its low expansion, its dimensional stability, and the fact that it does not soften noticeably with the heat reached in model engines. The primary disadvantage is its weight, which is about 3 times as much per cubic inch as aluminum. This is somewhat offset by the fact that iron does have a higher modulus of elasticity than aluminum, and it is possible to make an iron piston that's thinner than an aluminum one and still maintain its shape. Iron pistons are usually run in soft steel liners. Most of the model engines in the past 50 years have been built in this combination. The iron can be fit very closely in the steel liner. The expansion co-efficients of both are about the same, and should the parts rub too hard, the iron tends to burnish and not gall. To the user, an iron piston/steel liner motor has a freeness and a snap-over compression not readily achieved with any other combination. The primary disadvantage of the iron piston and the soft steel liner is that as you get into larger and larger out-put motors, it becomes more and more difficult to keep the expansion of the cylinder liner and piston matched. At one time we produced the 59 with an iron piston and steel liner, but today our 40 Standard is the largest that we feel is practical.

The second, very popular, piston and cylinder combination is the use of a hardened steel liner and an aluminum piston fitted with 1 or 2 piston rings. A lot of motors of yesteryear used this combination. The McCoy and the Hornet were outstandingly successful. This combination worked very well and had a light piston which was relatively vibration free. However, the success of this combination depends on having a quality piston ring. Unfortunately, only one piston ring company seemed capable of producing an acceptable quality ring, and when they were swallowed by a conglomerate, quality model size rings became unavailable. K & B solved their problem by developing the Dykes ring to an acceptable quality. We solved our problem by developing a new method of shaping conventional design piston rings. Licensing of this patent is now available to interested ring manufacturers. The primary advantages of a steel liner-ring piston motor is its ability to accept abuse — over lean runs, dirt, no warm up, etc., and the fact that it can be flown out of the box without fear of damaging it or seizing the piston. About the only disadvantage is that the cylinder webs reduce the power output slightly over the other two types.

Now, to A.B.C. or A.A.C. type cylinder/piston combinations. A.B.C. is an abbreviation for Aluminum (Piston) Brass (Liner) Chrome (Plated). A.A.C. is an abbreviation for Aluminum (Piston) Aluminum (Liner) Chrome (Plated). The problem of getting a good piston ring was probably a substantial cause for the increased popularity of the so called A.B.C. type piston and cylinder combinations. This amounts to an aluminum piston with no rings, but cast out of one of the modern high silicon, low expansion aluminums which is fitted into a brass liner, which has been chrome plated. The chrome plating produces a hard wearing surface to keep the cylinder liner from wearing out. An aluminum piston run in a brass liner with no plating would be completely worn out in 10 or 15 minutes. However, hard chrome is expensive, difficult to apply evenly, and almost impossible to hone once it's on. In order to even make a very small shape and surface improvements, we have had to resort to diamond and borizon honing stones to make a few tenths corrections in our A.B.C. liners when they come back from plating. Now, not everybody claiming an A.B.C. cylinder really has hard chrome on it. Some cylinders have used polished chrome, like that put on automobile bumpers. This is much softer and can be honed, but also it wears out quicker. It is cheaper, however. Also, there have been some cases where manufacturers have used electroplated nickel or electroless nickel. Nickel, compared to chrome, is very soft. Furthermore, nickel has more adhesion problems to the base metal. Our advice is to stay away from cylinders that are nickel plated or polish chrome plated. For an A.B.C. cylinder and piston to work right, a cylinder should be either a low expansion aluminum of the #390 alloy variety, or brass, and should be hard chrome plated. The piston must be one of the high silicon type, the most usual being the #390 alloy. The advantage of the A.B.C. is that when it is properly fit, the motor will run slightly faster than the ring motor, primarily because the webs in the cylinder which retain the rings on the ring motor can be removed and leaves a little more porting area. The disadvantages are first, one of cost, and second, that the motor must be handled more carefully than a ring motor. The warm up period, particularly, is vulnerable. If an A.B.C. motor that is cold and still relatively new is started and run at full power immediately, the piston heats up faster than the cylinder and, consequently, expands faster. It is not unusual for the piston to stick in the top of the cylinder with such force that the inertia pulls the rod apart. However, an A.B.C. that is carefully handled and is operated properly will last a very long time and runs very smooth.

CRUSADER

(Continued from page 21)

template given on the plans. There are, however, some special features in the Crusader wing, which should be incorporated into whatever wing is constructed. For those who prefer a built-up-type wing, note that the plans offer an alternative method of construction. The small half-size drawing is used only to show the correct wood sizes and the rib locations. Build the wing structure directly over the plans using the full-size wing outline as a guide. Any special construction notes are indicated on the plan.

The first of the features is the recess in the leading edge of the wing to allow installation of the fuel tank as low as possible. The cutout is made and a piece of Celastic is soaked in thinner and pressed into place with the fuel tank to be used.

The rear edge of the wing is left flat, and the ailerons are beveled 20 degrees on the leading edge to allow free movement with the nylon hinges shown. The pins through the hinges are installed about ¼ inch in from the edge of the surface.

The aileron servo is protected by a light aluminum can with tabs bent under and the servo-mounting screws holding the can and servo in place.

To construct the fuselage, lay out sides on 3/32 x4x51-inch balsa sheets, trimming the top edge with a straightedge. I've found it easiest to place the two sides one above the other, but mirror-image to each other. Place a full-length ⅛x¼-inch longeron along the top. A ⅛-inch sheet doubler with grain at 45 degrees extends from the nose ring to the wing trailing edge. Glue 6mm plywood over this doubler, and place a ⅛x¼-inch truss aft of the trailing-edge area. The wing and cowl cutouts are made with both sides pinned together after the balsa and plywood doublers have been glued in place. This prevents any wing/fuselage misalignment, and ensures a good cowl fit.

Mark the cowling cutout, the airfoil cutout and the exact line from the trailing edge of the wing to the end of the tail cone. Cut carefully, so that the sides will be identical. Separate the sides and glue the engine-mount bearers. The bearers should be pre-drilled, and blind nuts should be inserted prior to gluing.

Join the fuselage sides to the ¼-inch fire wall and ¾-inch bottom block.

Prepare the full-length top block by splicing for length and adding ¾-inch sheet to the top. Draw a straight line

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down the center line of the underside of the top block to ensure a straight fuselage. (If you aren't confused by now, read on!) Mark off the width of the fuselage at several stations, draw a connection line and cut a block with a band saw, keeping the cut line 1/8 inch outside of all outlines. The side view is then drawn and cut to shape.

Spot-cement the fuselage sides to the top block using a temporary 1/4-inch bulkhead at the rear of the wing and several 1/8x1/2-inch temporary spacers down the fuselage sides.

Carve and sand the top block to shape. Remove it from the fuselage and hollow out, referring to the cross sections shown. Make the cockpit cutout at this time. Cut off the removable tail block, and permanently join the top block to the fuselage.

The Fox .59 is bolted to the 3/16-inch aluminum spacer with 6/32 machine bolts, and this spacer is bolted to the 1/4-inch aluminum mounting place with 4/40 bolts. Mount the plate in the fuselage using a 5/8-inch Veco extension shaft on the engine. The 1/4-inch plywood ring is glued and held in place by the back plate of the spinner tightened down with the prop nut. Finish shaping the nose section.

Remove the engine to construct the cowling. Put a small shim of balsa on the rear of the plywood ring to allow the removal of the cowling. Carve the balsa block to shape. A 5/8-inch-diameter drill in a drill press can be used to roughly hollow out the intake section of the cowling, punching through from the front to the back. Finish hollowing the cowling. The top and aft edges of the cowling are reduced 3/32 inch and faced with 3/32-inch plywood.

The plywood former at the stabilizer leading edge may be installed and the bottom of the fuselage sheeted.

Construction of the empennage is conventional and shouldn't present any problems. The rear stab hold-down is a commercially available Cam-Loc obtained from an aircraft-supply house.

To reduce the finished weight, the model is covered with Japanese tissue applied over several coats of clear dope. Brush four coats of clear dope over the tissue, wet-sand, then spray on sufficient pigmented dope to cover. The model is trimmed, the decals applied, and several coats of clear dope are sprayed on carefully so as not to dissolve the decals. The inside of the cowl is finished with Hobbypoxy.

The nose-wheel brake is a simple device that engages the shallow notches in the rubber tire. When I'm asked how this brake works, I quote its designer, Milt Boone: "Every time!"

PERFORMANCE: This second version of the Crusader almost flew "off the drawing board," and completed a full AMA pattern on the second flight. No major trim problems were encountered, and the only adjustments were to the length of the elevator control horn. At the time of writing (November 15, 1964) 16 gallons of fuel have been run through the model, with no serious structural or equipment damage.

While this model wasn't intended to be a scale or nearly scale craft, it does combine a realistic appearance with excellent aerobatics and ground handling. I hope that the Crusader will be the first in a movement toward more realistic competition aircraft.

QUIET FLIGHT

(Continued from page 24)

opened a real can of worms here, but I'd like to hear what *you* think about this, as it looks as if HLGs will be around for quite a while.

Model Of The Month

This month's model comes to us from Dennis Brandt of Cypress, CA. Dennis' Cheetah is a 113-inch-span full-house thermal soarer. It has rudder, elevator, barn-door ailerons and spoilers. The wing uses the ever-popular Eppler 205 airfoil and is a conventional built-up D-tube structure. The wing area is 932 square inches, and the flying weight is 75 ounces for a wing loading of 11.5 ounces to the square foot. I'm not sure if the Cheetah was designed by Dennis or by Larry Jolly, but I do know that Larry is planning to kit it. The model should be available very soon. As soon as I have a price and release date, I'll let you know.

How does it fly? Great! I've flown against Dennis in many contests, and the combination of Dennis and the Cheetah is hard to beat. Even though it has a wing loading of 11.5 ounces, I've seen Dennis catch low-level thermals and turn them into winning contest flights. Yes, Dennis is an exceptional pilot, but he claims that the Cheetah will slow up and work light lift better than most models using an Eppler 205 at this high wing loading.

Another area the Cheetah handles well is the landing circle. It comes in rock steady, and the combination of barn-door ailerons and spoilers makes high-point landings a cinch. Remember, if you have an interesting model, send in a couple of black-and-white photos and a description, and I might feature your model in a column.

Astro Flight Champs

The 14th Annual Astro Flight* Electric Championships will take place on June 11, 18 and 19. The power events will be held at Sepulveda Basin in the San Fernando Valley, CA, on Saturday June 11. The sailplane and old-timer events will be held at Fairview Regional Park in Costa Mesa, CA, on June 18 and 19.

Since I'll be CD-ing the sailplane and old-timer events, I'll give you a little rundown on what will be happening. For the first time, this part of the Astro Champs will be a two-day event with four rounds. The duration part of round one will last three minutes, round two will last five minutes, and round three will last seven minutes. In round one, a 7-cell sailplane will get a 25-second motor run; a 7-cell old-timer, a 40-second motor run; an unlimited sailplane, a 15-second motor run; and an unlimited old-timer, a 25-second motor run. In round two, a 7-cell sailplane will get a 35-second motor run; a 7-cell old-timer, a 50-second motor run; an unlimited sailplane, a 20-second motor run; and an unlimited old-timer will get a 30-second motor run. In round three, a 7-cell sailplane will get a 45-second motor run; a 7-cell old-timer, a 60-second motor run; an unlimited sailplane, a 25-second motor run; and an unlimited old-timer, a 35-second motor run. All three rounds will be scored man-on-man, both sailplane classes will have graduated spot landings, and both old-timer classes will have in/out landing circles. Round four will be a five-minute flight with the motor run subtracted from the total. The pilots can run their motors as long as they need, to get a total of five minutes in the air. The time that the motor is run (plus the time that the pilot is over or under five minutes) is subtracted from the total air time. Landings will be the same as for the first three rounds. Scoring for round four will be straight points per second, no man-on-man.

The entry fee is a modest $5 per class. Astro Flight and several other manufacturers are donating great prizes, and these are usually given away by random drawing. Trophies will be awarded in each class to third place. If you're into electrics, this is THE electric event of the year, and you shouldn't miss it!

More PSS

Last month, I featured Brian Laird's PSS

(power-scasle soarers) as the model(s) of the month. I also mentioned that Brian was working on a P-51 sloper. Well, I have good news on top of good news. Brian has now completed the P-51, and he's decided to sell his partial kits through direct mail.

There are four models in his line: a P-51, P-39, Me-109 and a Spitfire. The partial kits consist of polyester-glass fuselages, foam cores (Eppler 374 airfoil) and full-size plans. They're available from Slope Scale* and cost $50 plus shipping. (CA residents add 6 percent sales tax.)

Till next time—good thermals and a full charge!

**Here are the addresses of the companies mentioned in this article:*

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728.

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Astro Flight Inc., 13311 Beach Ave, Marina Del Rey, CA 90292.

Slope Scale, 4047 W 141st #5, Hawthorne, CA 90250. ■

ENGINE REVIEW

(Continued from page 30)

that intake timing is symmetrical. However, the opening period is reasonably generous at 128 degrees of crank angle, the intake being uncovered at 64 degrees before top dead-center and closing at 64 degrees after TDC. Exhaust and bypass periods are also quite "modern" at 144 degrees and 120 degrees respectively.

Like most other designs of the pre-war period, the K-6 includes an integral fuel tank. This is of the translucent plastic-bowl type, with an aluminum top that's cast in one piece with the air-intake pipe. The latter has a machined bell-mouthed entry and is fitted with a vertical spray-bar-type needle-valve assembly. It screws into the cylinder-intake boss where it's locked in position with a hexagonal nut. The tank top is provided with a spring-loaded filler cap (patterned after the once-familiar Gits cap, which was fitted to many American engines of the period) and is threaded on its periphery for the knurled ring that retains the tank bowl.

Incidentally, the intake pipe is only 6.5mm i.d., whereas the spraybar o.d. is 4.5mm. This means that the effective venturi area is only 6.4 square mm. This ensures strong fuel suction, but makes a startling comparison with the massive 95 square mm of the latest pump-equipped O.S. Max-61RF-P engine.

Most pre-war engines of size similar to the K-6 were equipped with the ⅜-inch spark plugs that leading plug manufacturers (like Champion and AC) made specially for model engines. Production of these, along with those of other plug makers, such as KLG and Lodge in England, was discontinued nearly 40 years ago when post-war model glow plug and diesel engines virtually eliminated the spark-ignition engine for model planes. However, an excellent and reasonably priced commercial replacement is now available as the slightly larger 10mm-size NGK CM-6. This is the plug fitted to the O.S. Type-6 Replica.

Also supplied with the engine are an appropriate ignition coil, coil clip, condenser and HT lead. The coil is U.S.-made by Micro Model Engineering of Sturgis, MI, and it's suitable for operation on a 2.4V nickel-cadmium pack (450mAh or 1,200mAh suggested) or up to a maximum of 4.5 volts in dry cells. A 450mAh Ni-Cd pack will give about 12 minutes of running time between charges, while a 1,200mAh pack will allow about 30 minutes. For the benefit of those unfamiliar with spark ignition systems, a wiring diagram is included in the instructions supplied with the engine. Incidentally, this also includes a reproduction of the original Japanese instruction booklet supplied with the K-6 in 1940!

The Type-6 is, of course, intended to run on a mixture of regular non-leaded gasoline and motor-oil. However, rather than the heavy SAE-70-grade lubricant commonly associated with model spark-ignition motors of the '30s and '40s, O.S.

now recommends one of the modern 2-cycle mixing oils. The advised proportions of gasoline to oil are 4-to-1 (5-to-1 after break-in). Gasoline fuels call for lower compression ratios than are possible with alcohol-based fuels, and the checked nominal (full-stroke) compression ratio of the Type-6 was less than 6-to-1. This is reduced to approximately 4.5-to-1 when re-calculated against the effective swept volume above the exhaust port.

The original Type-6 had a bore and stroke of 23x22.6mm, giving a displacement of 9.400cc or 0.5730 cubic inch. In the Type-6 Replica, the stroke is rounded up to 23mm, which increases displacement to 9.556cc or 0.583 cubic inch. The engine is slightly heavier than the original at just over 11.6 ounces bare. This is increased to 13.4 ounces with the ignition equipment and to a total flying weight of between 16 and 18 ounces, depending on the type of battery chosen.

In common with the original K-6 and its contemporaries, the Replica doesn't have a throttle. Such a refinement would have had no practical use in the days of free-flight, but a measure of manual speed control is available via the ignition advance lever or "timer arm." This allows the ignition point to be retarded for easy, kick-free starting, after which the spark can be advanced and the needle valve gradually closed until maximum rpm are achieved. If needed, a reduced power setting can be obtained by partially retarding the spark in conjunction with a slightly richer needle-valve setting.

The Type-6 doesn't have the high-speed power output of a modern O.S. engine. Recommended prop sizes are 12x6 or larger, and that's just what's needed for a typical old-timer.

Although better made, the Replica is, as already mentioned, a true reproduction of the original model. Inevitably, it perpetuates some of the shortcomings (by modern standards) of a design that is now nearly 50 years old. For example, it doesn't have an exhaust muffler and, because it has a cast-iron piston (also a bronze conrod), it doesn't run as smoothly as a modern model 2-stroke.

These characteristics are inseparable from the demands of collectors who expect a faithful copy of the original. The O.S. factory has stated that the Type-6 Replica will remain a strictly limited edition of 2,000 copies and won't be compromised by modifications rendering the engine unacceptable to purists. Instead, for the benefit of those whose only interest is in actually flying old-timer-type models, O.S. is developing another spark-ignition engine of vintage character, but incorporating subtle changes, such as a ringed aluminum piston, aluminum-alloy conrod, ball-bearing shaft and a capacitive-discharge ignition system. When it reaches the production stage, I'll give you more information on this latest development.

BD-5J

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this. Care is needed, since the fiberglass removed becomes the moving cover.

A problem developed with the plastic frame associated with the side ducts. They fit properly but, when all was assembled, the weight of the door hinges and springs made the bottom rail of the frame bend downward, so making it difficult for the door to fit at the top rail. I supported the bottom frame with some triangles of sheet balsa glued into place with CA. This was an adequate remedy,

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but the frame should really be made of heavier material.

The nose section and its associated servo and nose-gear mountings were quite easy to complete. However, installing the servos, after the wooden structure is installed and glassed, is a difficult task. The problem arises because there's insufficient room to really get a tool to the servo mounting screws. The problem can be eased by drilling pilot holes before attempting to install the servos and then inserting the screws and removing them. This will tap the screw holes and reduce effort needed to put the screws in place when the installation is eventually attempted. I suggest that the servo be removed before glassing the assembly in place, unless you're very careful with the resin. The installation is difficult, but not impossible. I cut most of the handle from a No. 1 Phillips screwdriver, and was able to torque things into place with this.

The wooden nose structure needs a wheel cutout in F-7; the photos show this, but the drawings don't, and this part doesn't have a die-cut opening. Also, drill mounting holes for the two air valves. I didn't do this, and I ended up having to burn the holes in place with a heated piece of right-angle spring-steel wire.

A thrust attenuator is an option for the BD-5J. This device, frequently called a "clam shell," mounts aft of the exhaust tube and is operated by two air cylinders. The attenuator greatly reduces thrust and makes idle adjustments almost unnecessary. It's also great for "getting on the pipe" before takeoff and for full-throttle taxiing and flight approaches. It's a new dimension, and I suggest you consider it; the device is simple to fabricate, install and adjust. However, don't install it in the sequence suggested in the instructions. Hold off until F-10 is installed and flap linkage is finalized. The two control rods to the attenuator will only get in the way when F-10 is being installed.

If you've ever assembled a Byron kit, the BD-5J wings will be quite familiar to you. The instructions are quite clear, and no problems were encountered. Rom-Air retracts with a belly-mount nose gear are called for, and that's what I used. Installation is a simple bolt-in job. Be sure that all hose connections are firmly installed. A large plastic bottle holds the air supply and drives both the landing gear and the attenuator.

When I first tried to charge the system, I knew I had a massive leak. I nearly went crazy trying to find it! Enough soapy water was put on all connections to turn the Acrojet into a boat, but with no luck. In an attempt to isolate the leak, I finally resorted to clamping off sections of the system with a medical clamp. It turned out to be in the attenuator system—actually, the air valve. It wasn't a faulty valve, however, but was caused by a mistake on the drawing labelled "Air Systems Schematic." The problem was a connection between the two outlets on the side opposite the air input. These outlet tubes must *not* be connected, but must be closed off with a dab of solder or by some other method.

After that, the gear and the attenuator worked well. I'd forgotten how fine the Rom-Air retracts are, as it's been a long time since I've flown pattern, where they were the standard for many years. The gear is very reliable when properly installed.

I set the rudder-wire horn ⅛ inch or so higher than shown. If installed as directed,

there will be a slight dimple in the thrust tube, and a slightly higher position eliminates this.

The other building steps posed no significant problems.

This kit will take considerable time to complete. Byron's ads indicate that the plane builds "fast and easy." Frankly, I think they really mean "faster and easier" than similar scratch-built projects. Don't expect an ARF-type experience, because producing something this good-looking and airworthy takes hard work and skill!

I wanted the lowest weight possible, so I opted for heat-shrink plastic covering and chose Coverite's* Black Baron film. The stuff worked well directly over foam, but I needed to increase the heat to 200°F (50° over the recommended level) to get proper adhesion and shrink. I used Black Baron's recommended technique to do one panel, and this involved using only an iron. The other panel was done using my own method of tacking all edges down and then shrinking the plastic with a heat gun. The second procedure gave the best results, although both wings turned out well.

All trim (including the over-paint) was done with Black Baron Trim-Film. This vinyl material is absolutely the finest trim material I've ever used. It stretches around curved surfaces, goes on smooth and, once on, it stays on. The fuselage was painted using spray cans, because I wanted a perfect color match between the fuselage painted surfaces and the flight-surface film covering. I didn't get the perfect match, even though the paint-can label said I would. The painted surface is several shades of grey darker than the film. This was disappointing, but it didn't look too bad. In fact, for a reasonably quick, good-looking, fuelproof finish, I recommend the Black Baron film/paint/trim route. However, Coverite should get these colors to match more closely.

The Byro-jet fan unit was matched to an OS* 77 VR for ducted fan. This is a beautifully made, high-performance, reliable engine for a demanding power style and difficult operating environment. It includes an outstanding carburetor that's easy to adjust and also oversize head fins to help with cooling. I ran the engine on a test stand to break it in prior to installation, and I advise you to do the same. The 77s I've seen in other Byron jets pump out quite a tail blast—around 12½ pounds, or so it's claimed. One thing's for sure; at a finished weight of 14½ pounds (several ounces *under* the design weight) the BD-5J ought to show pretty good vertical performance. We'll see!

PERFORMANCE: For obvious reasons, in February in the New York area, one doesn't usually indulge in lengthy flying sessions. On the day of the Acrojet's first flight, it was clear and cold with a steady wind—actually very acceptable conditions. But only one flight was made—that was enough!

Even though the OS 77 had been broken in with a propeller, it still took some time to get it peaked, on the pipe and idling properly. The engine tended to change from rich to lean as the fuel head dropped. This was probably because the tank center is a bit above the carb center and no pressure was employed. I think the pipe should be tapped to provide pressure, or a Perry pump could be used as a flow regulator. Nonetheless, we were able to get a satisfactory first flight.

When all was well, young Rick Lucas,

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Small Steps

by JOE WAGNER

SMALL R/C MODELS are fun to fly, and often very educational. For example, armed with a tiny .020-powered R/C model, I recently solved one of aviation's most hotly debated mysteries: the problem of the downwind turn.

I've had the airplane—my all-sheet-balsa "Starling"—for several years. With rudder-only control via Ace R/C's* old "Pulse Commander" proportional system, the Starling is always docile during calm weather. It circles readily in either direction and has no bad habits.

However, when it's windy, my Starling displays the dreaded "downwind turn" symptoms in truly classical form. It speeds up considerably going downwind; then, when I head it back upwind again, it zooms and stalls, apparently from the excess velocity picked up when traveling in the other direction. Anyone watching me fly this model in the wind would be easily convinced of the existence of a Downwind Turn Demon.

Yet aeronautical engineers (I'm one) maintain that any aircraft flies exactly the same in a steady wind as it does in calm air. Flying downwind, its air speed is just the same as it is when it's headed into the wind, or even crosswind. Ground speed varies, of course, but that doesn't matter to the aircraft; it's traveling *within* the air, which may be moving (or not) with respect to the surface without affecting the flight characteristics of the airplane in any way.

Knowing all this, yet still puzzled by Starling's misbehavior in windy weather, I determined to find out why it flies as if pursued by the Downwind Demon. I recently took it out on a breezy day to make some analytical test flights, and I solved the great mystery.

By paying close attention to exactly what was happening during these flights, I found that Starling's into-the-wind zooms were neither its fault nor the fault of the weather. *I* was the guilty one!

Starling is light and flies slowly. In calm weather it's no problem to keep it close, but in the wind I have to work hard to keep it from being blown into the next county. Rather than flying in the same gentle circles as when it's calm, I command Starling to turn sharply upwind whenever it's headed the other way; then I straighten it out abruptly to keep it headed into the wind and so make up for the downwind drift.

Our prolific Mr. Wagner holding the Starling—one of his many successful small designs.

That's what causes the problem. Any airplane will drop its nose and pick up speed in a tight, steeply banked turn. Rudder-only R/C models show this tendency very strongly, because there's no elevator control to help compensate. Thus, when I hurry Starling through a turn in the wind, it picks up the speed that makes it zoom and stall when I straighten it out quickly. This excess air speed is purely a result of the steep turn, and the wind has nothing to do with it. I can cause exactly the same zooming and stalling in calm air. A sharp half-circle followed by a sudden return to straight flight will do it every time.

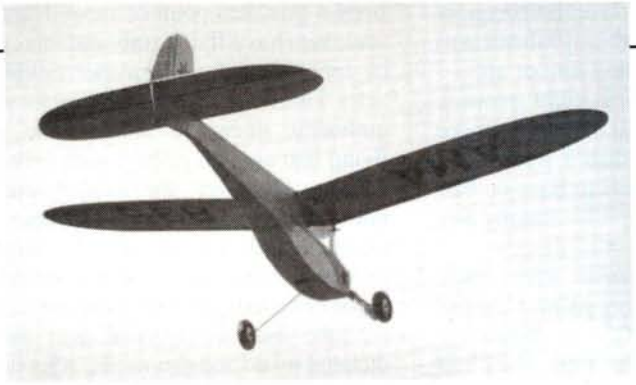
Speaking of rudder-only models, until Bill Cannon came out with his Super Micro system, Ace's old Pulse Commander equipment supplied the only practical way of controlling a tiny R/C airplane. It was light, simple and inexpensive, too. Many R/C fliers first learned to fly proportional with this setup, and despite its limitations (control restricted to the rudder alone, which constantly oscillates back and forth like a fish's tail throughout the flight), lots of modelers liked the Pulse Commander very much indeed for school-yard R/C flying.

Ace discontinued making this equipment three or four years ago. Since then, they've received quite a few requests that they re-issue it, but (so far) Ace isn't planning to put the Pulse Commander back in production. However, they *are* willing to convert existing Pulse Commander systems to the new frequencies.

I just talked with Tom Runge at Ace R/C, and he says they'll change any Pulse Commander transmitter/receiver pair to one of the now-authorized frequencies for $22.50, plus shipping charges.

Model airplane contests have always been an enjoyable part of model flying, but airplanes powered by the smaller engines rarely seem to compete. This might be because the AMA has no engine classifications in R/C, as they do for free-flight competition. It seems a shame that we who fly small R/C models are effectively denied the fun of competing against one another.

Randy and I have been discussing this, and we've decided to put on two special



Starling in flight, gliding in for a landing. With an under-cambered sheet-balsa wing, the Starling flies quite slowly.

meets just for small-engine airplanes. One will be held in the area of Dallas, TX, and the other in western Pennsylvania. Our tentative dates are mid-September for the Pennsylvania meet and October for the one in Texas.

Here's what we've planned; we propose to divide the small motors into classes as follows:

- Class X=.000 to .085 cubic inch displacement, inclusive.
- Class Y=.086 to .185 cubic inch displacement, inclusive.
- Class Z=.186 to .285 cubic inch displacement, inclusive.
- Class E=Electric motors; .075 maximum.

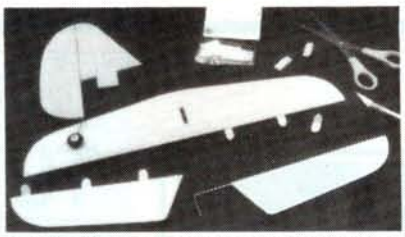
(A multi-engine model would be classified on the basis of the size of its largest motor and not by its total engine displacement.)

The events will be rather low-key, with the emphasis upon sport-type airplanes rather than on precision aerobatics or museum-quality scale models. We'll try to offer a scale event for each engine category, and scoring will be based largely on realism in flight. Scale judging will be much like the Flying Aces Club system for scale models, with only the most basic documentation required.

As for aerobatics for the sport-type airplanes, we'll concoct a simple schedule of maneuvers, and this won't be announced in advance. At the contest, each entrant will be given a Xerox copy of the pattern, so he or she will know what to expect, but there won't be any "caller" involved. The judge (or judges) will stand next to contestants as they fly and will call out the maneuvers.

Starling's flip-flop rudder and the Ace Pulse Commander transmitter that controls it. Ace R/C will convert P-C systems to modern frequencies.

This could become a highly popular form of competition, as long as we can keep the contest low-key and emphasize just having *fun*. Of course, we'll have awards: a lot of small trophies or plaques rather than a few gigantic ones; and attractive souvenir T-shirts for all contestants.



Installation of Easy Hinges in the Osprey's tail surfaces. For small models, the hinges are cut in half; trimming corners off aids insertion.

Randy and I would like to know how *you* feel about this contest. We're open to suggestions, criticisms and wild ideas. We want to make these meets as enjoyable and memorable as possible, and your input will be of great help in finalizing our plans. Just be sure to enclose an SASE if you want a reply!

A few columns back, I mentioned trying "Easy Hinges" on one of my small R/C models. I disliked their stiffness, but they are by far the easiest hinges to install. I decided to experiment with them to see if the stiffness could be reduced. It can! The trick is to install them with white glue instead of CA. Easy Hinges consist of a thin strip of polymer plastic with an absorbent material like thin paper toweling on each side. They're not excessively stiff before installation, especially if you flex them sharply a few times before putting them in. But when you use CA to cement Easy Hinges in place, the fuzzy surfaces on their outsides soak up glue, too. When this cures, it effectively makes the flexing portion of the hinges roughly three times as thick, so no wonder they stiffen up!

White glue is far better, as its stiffening effect is minimal. Although it's somewhat slower to install Easy Hinges with white glue, I think it's worthwhile, as you gain greatly increased flexibility.

I brush white glue thoroughly onto both sides of the half of the Easy Hinge I'm about to set in place. Then, with a thin watercolor brush, I force glue into the knife slot where the hinge is to fit. (The water in the white glue tends to swell the wood, so I enlarge the slots with a metal nail file before gluing.) Then, with the Easy Hinge folded over on its "flex axis," I push it firmly into place and wipe off the excess glue.

When all the hinges have been installed in one component, I allow at least a couple of hours drying time before installing the assembly to its mating surface. To do that, I use the same brushed-in white glue procedure to cement the free ends of the Easy Hinges in place. Of course, this must be done with three or four hinges at once, instead of one at a time. Since white glue dries slowly, there's plenty of time for manipulation to get the hinge gap exactly right.

Now over to you; I won't complain if I'm deluged with mail!

**Here is the address of the company mentioned in this article:*

Ace R/C Inc., 116 W. 19th St., Box 511C, Higginsville, MO 64037.

BD-5J

(Continued from page 87)

my first-flight test pilot, blasted the BD-5J from the runway. The jet proved itself to be very capable in just one pass around the field. All control surfaces had been set as instructions indicated; and balance was right with no lead needed fore or aft.

The flight lasted about eight minutes. There's no question that this bird is more of a pattern airplane than a ducted-fan scale airplane. It appears to have no bad habits and can accomplish virtually any maneuver.

The big surprise came when Rick started to set up a landing pattern and the engine stopped. It will take more running to get that big OS 77 just right. Rick had the Acrojet at about 50 feet, several hundred yards from the landing point. When the jet flew past us, it was still 20 feet high. This 14½-pound jet *is a floater* and so clean it seems to go on forever. No flaps were used (first-flight landing is no place to try flaps), but they surely would help this slippery, long-glide tendency. A wheel-up belly landing was executed since the runway was quite rough. There was no damage except for that inflicted on the pilot's fragile ego!

I'm more than pleased with my Byron Originals BD-5J. It isn't a perfect airplane, but it's close. There are a number of scale deviations, some of which are necessary from a practical point of view. The full-scale bird has a flying stab, and this could be incorporated with proper modifications. This would be unnecessary for pitch authority, since the BD-5Js I've seen flying had enough pitch power to satisfy anyone. However, the mod might be interesting to play with. The side ducts are placed a little higher, are of a slightly different shape and probably could be made close to scale with some effort. The jet tube itself is oversize, and this is dictated by ducted-fan needs. A lot could be done with the landing gear to create a more scale look. Flap/aileron division is off-scale, with the model's ailerons being proportionally much bigger than full scale. This could probably be changed if you're willing to give up some roll authority.

The one non-scale feature that bugs me is the painted canopy. The plane would be so much nicer with a tinted or clear canopy. Unfortunately, the plenum door in the model's canopy dictates the need for paint. There are also a tank and a pipe in that upper area. I wonder if some relocation and a plenum door in the bottom with appropriate ducting might not permit a scale canopy. Oh well, that's all for my second BD-5J; I've already bought the kit for No. 2! If that isn't a recommendation, I don't know what is!

**Here are the addresses of the companies mentioned in this article:*

Byron Originals, P.O. Box 279, Ida Grove, IA 51445.

Coverite, 420 Babylon Rd., Horsham, PA 19044.

O.S.; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

CHIPMUNK

(Continued from page 44)

to work with and has great shrinkage properties. Also, Ultracote can be applied over itself with few, if any, bubbles, by using an iron at a low heat setting. This considerably reduced the chore of applying the stripes on the wing and on the tail. A sketch of the top and bottom wing trim scheme is shown on the plan, but the builder must estimate the decal locations from pictures on the kit box top and on

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AEROBATICS

(Continued from page 27)

level at the bottom, you should have the sticks back to normal level-flight positions.

Doesn't sound difficult, but it's really quite hard to do the maneuver correctly. Good pilots always start from straight and level, maintain the wings in level attitude, and ease the ship into the loop using as much of their power as possible to pull through the loop (neither stalling at the top, nor pulling 10 Gs in the process). The loop looks graceful and easy, rather than quick and violent.

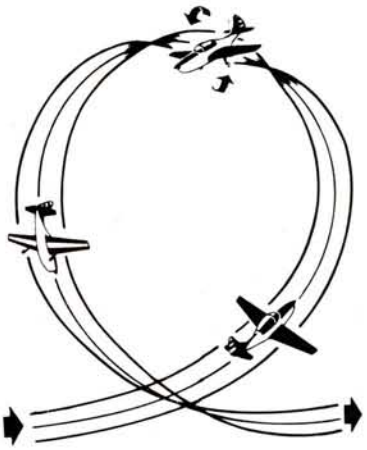
The roll is another deceptively hard maneuver to perform right. Again, most sport fliers just nail the stick to the sides and wait till the ship comes back around to level. Most of the time, it has lost altitude and is heading slightly nose-down.

Here's how a good pilot does the roll. Again, from straight, level flight, ease the aileron stick over to the side fairly rapidly (but not nailing it)—We want to do a controlled roll. As the ship rolls through the first 120 degrees, the nose will begin to drop. This is because the ship is trying to fly on the fuselage at 90 degrees. To hold the nose level, use top rudder to change the angle of nose attack through the 90-degree mark. Of course, if the ship is rolling fairly rapidly, you probably won't need rudder, as the ship hasn't yet started to fall.

As the ship rolls to the inverted position, it will definitely begin to drop its nose, as it's normally trimmed for level flight in the upright (not inverted) condition. We compensate here by adding just a tad of down elevator as the ship rolls through; a one-second stab of down elevator, starting at about 140 degrees and ending at about 230 degrees (the 8 to 2 o'clock wing position to the 10 to 4 o'clock wing position). The idea here is to add just enough elevator so that the nose doesn't drop, but neither you nor any other watcher can detect the elevator input. After this portion of the roll, with the exception of the continued aileron application, the ship can be left alone until it attains straight and level attitude again. This roll should take about two to three seconds. (Done just a hair longer, and you have the slow roll.)

It takes practice to coordinate the stick movement to obtain just the right amount of elevator during the roll and to maintain a consistent roll rate without letting the ship deviate from an imaginary straight line. That's the idea behind a true aileron roll. Straight and level entry, rolling through 360 degrees about the roll axis with no deviation from the original flight path. Sounds easy, but it's tough to do with grace and precision.

Lastly, the stall turn. This maneuver is actually a stalled maneuver; the aircraft performs the turn at a speed lower than the flying speed of the aircraft. Simply put, it's an upward vertical leg that ends when the ship almost comes to a complete stop nose-high, and then pivots 180 degrees about the wing tip to a straight-down vertical leg. Now let's talk our way through it!



The stall turn begins in the same way as all other maneuvers—with a straight and level entry. To perform the maneuver, let the plane fly slightly to your side, rather than in front of you. In this way, you'll be able to see more easily what the plane is doing. When the ship is about 30 degrees to one side, pull it up smartly to straight-up vertical, making it as straight up as you can. When you've established a vertical leg, throttle back, and as the throttle hits the stops, quickly feed in the rudder. The ship should pivot right on the wing tip a full half-circle and head right back down the same path it went up. Ideally, the plane won't use more than two wingspans of length to perform the pivot. A true stall turn looks as though the plane has stopped in midair and turned around on the tip. Again, this sounds deceptively easy.

The snap roll is the only other maneuver that's considered to be a separate stunt. For the most part, the snap roll is a combination of roll, pitch and yaw, as well as a lot of stalling. In its purest form, the snap roll (and the spin, which is the same, but done vertically) is a stalled maneuver. It requires the total stalling of one wing-half, caused by massive inputs of pitch, roll, or yaw, or all three.

Now that we have the basics, how do we learn them? A good way to learn them is by becoming familiar with the basic methods (as described here) and then perfecting them by studying a competition book. The AMA, IMAC (International Miniature Aerobatics Club) and the FAI all publish books for modelers that describe what the stunts should look like in competitions. Most stunts are modeled after their full-scale counterparts. Ideally, if you want to learn a short sequence of stunts to impress the people at the field, you should pick up one of these books and take your pick of the over 50 different stunts described. Practice them until you not only feel comfortable with them, but also look good.

Now I'll describe how to perform a small air show. I've mentioned three books which deal with stunt flying. The first book, the AMA Competition Handbook, describes the maneuvers to be flown in front of judges by five classes of precision aerobatic fliers. This type of flying closely resembles the type of stunt flying performed by show teams in full-scale aviation. A maneuver is chosen and then performed in front of the audience. Having completed the maneuver, the aircraft zips out to the wild blue yonder until another stunt is chosen, and the plane then returns to the field to perform the next maneuver.

Flying the IMAC- and FAI-style aerobatics is more demanding. In this flying style, the aircraft is always in front of the field of contestants or the audience; performing a stunt in front of the field, performing another stunt to return to the center of the field, then another and a final stunt to return. It's a cycle of stunts, no two of which are repeated consecutively. This is the flying style of the full-scale Lasers, Zlins, Exxtras and Chipmunks. The formal name of this aerobatic style is the Aresti style.

There's really no superior style of aerobatic flying, as both the show-team style and the Aresti style require grace and precision to execute correctly. No doubt, the Aresti style necessitates more concentration and expertise to perform in the style and spirit of limited-airspace aerobatics. For a sample of what an upcoming stunt pilot like you can do for yourself and the crowds, let's look at a short Aresti aerobatics schedule and describe its execution:

The sequence here is the basic Sportsman's schedule, as used by the IMAC competition book. It consists of 13 in-flight maneuvers that are strung together

(Continued on page 118)

CHIPMUNK

(Continued from page 90)

the cover of the instruction booklet. I used Hobby Poxy* paint on the cowl, canopy, wing fairing and tips.

I installed my Futaba* FGK Series radio components and had plenty of room to spare. The completed Super Chipmunk weighed 7 pounds, 7 ounces for a respectable wing loading of 25 ounces per square foot. With the battery pack located under the fuel tank, the CG is right at the front of the recommended range.

PERFORMANCE: The day of the test flights was windy, with the wind coming from the left of our paved runway at about 45 degrees. Ground handling was hampered by the big fin, which acted like a weathervane. With careful use of right rudder, all takeoffs, except the first, were straight down the runway. In the air, the Super Chipmunk was oblivious to wind gusts and flew as if on rails. A few clicks of down trim were all that I needed for hands-off flight. The power of the OS .61 FSR allowed unlimited vertical climb. My control-surface throws had been set according to the instructions, and these proved to be good for all-around general flying and aerobatics. I *did* use low-rate aileron for the first couple of landings, but only until I was familiar with the airplane.

Boy, this model really tears up the sky! I think that *any* maneuver is possible. Later, I might want to move the CG aft and increase both rudder and elevator travel so that I can practice the more violent ones. So far, loops, rolls, spins, inverted and knife-edge flight have been very successful. This Super Chipmunk really makes you feel like doing wild things! On flight I took off into a vertical climb until it was almost out of sight, and then I let it spin down. I stopped at 24 turns to be on the safe side, but it came out of the spin so cleanly that I could have done a couple more.

The *real* surprise was its low-speed handling characteristics. I couldn't believe how docile it was. With the forward CG there was hardly any noticeable stall. All the controls were effective down to very slow air speeds. I could even hover it into the strong headwind. Despite its thoroughbred heritage, this Super Chipmunk was as friendly as a teddy bear. Indeed, its broad performance range will suit a wide variety of fliers.

Given reasonable care, the Carl Goldberg Super Chipmunk should hold up very well—probably better than an ARF version. Mine has developed a couple of cracks in the cowl: one behind the spinner (where a lot of material was removed for engine clearance), and one where the muffler was touching the inside. With a little fiberglass reinforcement in these areas, I probably could have avoided this. The Super Chipmunk has a very strong airframe, and I like knowing exactly how it was put together. It's also easily repaired with conventional materials.

By the time you read this, Carl Goldberg Models should have incorporated some improvements into both the instructions and the materials (e.g., the leading edge and spars). If you enjoy both building and flying, then you should consider the Super Chipmunk for your next project.

**Here are the addresses of the manufacturers mentioned in this article:*

Carl Goldberg Models, Inc., 4734 W. Chicago Ave., Chicago, IL 60651.

O.S. Engines; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Tatone Products Corp., 21658 Cloud Way, Haywood, CA 94545.

Hobby Poxy Division, Pettit Paint Co., Inc., 36 Pine St., Rockaway, NJ 07866.

Futaba Corporation of America, 555 W. Victoria St., Compton, CA 90220.

ABOUT ENGINES

(Continued from page 38)

doesn't keep well. (Glow fuel lasts indefinitely if stored in tightly sealed metal cans. I have some that I bought over 25 years ago from a going-out-of-business hobby shop, and it still works well.) Rather than mixing up a whole gallon of gas-type model fuel and then having to throw most of it out in a couple of months, it makes more sense to buy a pint can of "Blendzall"—a specially processed type of castor oil that mixes nicely with gasoline—and make only half a gallon of fuel at a time. Blendzall is made by Klotz and can be obtained from automotive specialty suppliers all over America.

One type of oil that should *never* be used in model engine fuel is the kind that contains Teflon particles. The high temperature of combustion decomposes the Teflon, and fluorine gas is released. Fluorine is the most corrosive element known; it even attacks glass! We don't want any of it inside our model engines!

**Here are the addresses of the companies mentioned in this article:*

Cox, 1525 E. Warner Ave., Santa Ana, CA 92705.

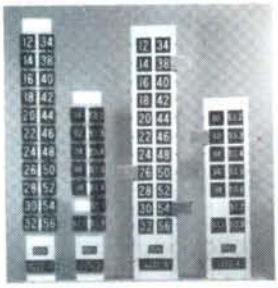
K&B Manufacturing, 12152 Woodruff Ave., Downey, CA 90241.

Herb Wahl, P.O. Box 51, Forksville, PA 18616.

Product News

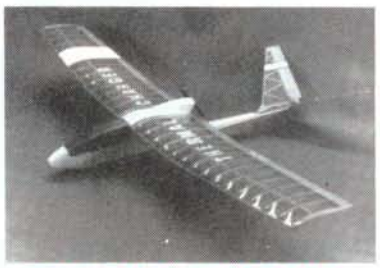
BIG BEE

Who said large couldn't be graceful? Designed by Joe Bridi, the Big Bee is a ¼-scale-size trainer with excellent flying characteristics and ground handling. It's capable of all AMA and FAI maneuvers. The easy-to-assemble kit comes complete with machined parts, wire landing gear and C-B tail-wheel assembly. To power the Big Bee, a variety of engines can be used, including a 120 (or larger) 2-cycle, or twin cylinder 2- or 4-cycle engines. For more information, contact Bridi Aircraft Designs, Inc., 23625 Pineforest Ln., Harbor City, CA 90710.



FREQ. CONTROL BOARDS

IDCo. Frequency Control-Board Kits cover the R/C channels/frequencies recommended during the second phase of the AMA frequency utilization plan. They provide an effective means of identifying the frequencies being used at model flying sites. Large, non-glare, black plastic plates with white numbers are highly visible and easy to read from a distance. These boards are designed to accommodate the proposed 1991 changes, and updated kits will soon be available. For more information, contact IDCo., N8024 Elser Dr., Beaver Dam, WI 53916.



THERMAL CHARGER

The Thermal Charger is one of GM Precision's three new 1988 kits. The Charger is a direct-drive electric sailplane that has been designed as an entry-level electric/sport electric plane. It uses a Leisure .05 electric motor, has a 60-inch wingspan and 545 square inches of wing area. The kit includes the Leisure motor, a switch harness (with micro on/off switch and arming switch) and propeller. For more information, contact GM Precision Products, Inc., 510 East Arrow Hwy., San Dimas, CA 91773.

THE VECTOR

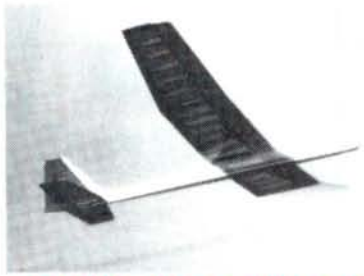
The Vector is a .40-size, high-wing trainer aircraft from Carl Goldberg Models. It has a flat-bottom airfoil, tricycle landing gear, and 630 square inches of wing area, making the Vector perfect for the first-time flier. Construction is a breeze, as the Vector comes almost completely assembled. The fuselage is built of balsa and plywood, ready for any finish. The 59-inch wing is foam core, with a sheet-balsa covering that requires little assembly. There are only 17 wooden parts in the kit, and they're all of top quality. All this, plus high-quality Goldberg hardware (like Klett hinges) make the Vector an excellent buy. For more information, contact Carl Goldberg Models, 4734 West Chicago Ave., Chicago, IL 60651.

GREAT LAKES 2T-1A

Ikon North West introduces yet another beauty from the Golden Age. The Great Lakes 2T-1A has a 64-inch wingspan and is designed to accommodate engines in the 60 to 90 4C range. With a 90 4C engine, the 2T-1A comes in at 10 pounds with outstanding performance. The kit features pre-cut pieces for ease of construction and pre-bent landing gear. To aid in wing construction, the drawings are inked with the full wing. For more information, contact Ikon North West, P.O. Box 306, Post Falls, ID 83854.

FIBERGLASS COWL

D&R Aircraft Manufacturing introduces a new fiberglass cowl (with flaps molded open) for the already-popular F4U Corsair Kit. The kit features a modular foam-and-balsa construction technique that makes the Corsair a pleasure to build. The foam wings are precision-cut, to make forming the gull-shaped wing a snap. The wingspan is 72 inches, and this makes slow, stable landings a breeze. The Corsair will take 2-cycle engines in the .90 to 1.08 range, or if you like the 4-strokers, a 1.20 to 1.60 will do the job. For more information, contact D&R Aircraft Mfg., P.O. Box 23056, Austin, TX 78736.



RISER 100 SAILPLANE

This standard-class sailplane from Sig Manufacturing was designed with the beginner and sport flier in mind. With a 100-inch wingspan and 1,000 inches of wing area, the Riser is one of the best floaters around. The kit features a die-cut Lite-Ply fuselage, precision die-cut balsa parts, a two-piece wing, a spoiler option and a complete hardware package. The ready-to-fly weight of the Riser is only 45 to 49 ounces, and this gives a wing loading of 6 to 7 ounces per square foot. For more information, contact Sig Manufacturing, Route 1-Box 1, Montezuma, IA 50171.

ET-40 TRAINER

Bob Martin R/C Models introduces the ET-40 Trainer. The ET-40 is designed for a .40-size engine and features easy construction, excellent plans, a photo-illustrated instruction book and precision-cut parts. The ET-40 handles well, both in the air and on the ground. It has a light wing loading (approximately 17 ounces per square foot), so it can land at very low speeds and is stable throughout the rpm range. For more information, contact Bob Martin R/C Models, 1520-C Acoma Ln., Lake Havasu City, AZ 86403.

PDQ CHIPMUNK

The PDQ Chipmunk from Royal Products is the latest addition to the PDQ line. It features a retract option and a motor mount that can handle .40 to .45 2-cycle engines as well as .60 to .90 4-cycle engines. Royal's PDQ construction features a plywood and balsa superstructure, which is sheeted with foam board and laminated with high-gloss pre-painted plastic. The result is a beautiful, flawless finish that won't sag or wrinkle in the sun, unlike the iron-on coverings. For more information, contact Royal Products, 790 West Tennessee Ave., Denver, CO 80223-2875.

SUPERSAFE LIQUID SOLDER FLUX

In an effort to give the hobby industry the finest products available, H&N Electronics has just introduced their new SUPERSAFE liquid solder flux. The flux not only comes in a flip-top bottle to make it easier to apply and to minimize spills, but contains no rosin, zinc, ammonium chloride or other strong acids or acid-forming substances. When heated during soldering, the flux is entirely neutralized. All soldering is easier—electronics, landing gears, etc.—*anywhere* soft soldering is done. For more information, contact H&N Electronics, 10937 Rome Beauty Dr., California City, CA 93505.

"STRIKING BACK" VIDEO

This is an action-packed program of Byron Original's amazing World War II re-enactment. This 30-minute tape was made with a combination of 16mm film and video. Remote-controlled film cameras were placed on the set to capture all the action and searing pyrotechnics. "Striking Back" is the result of over 400 hours of editing, and the result is a tape you must see to believe! Catch the action of "Striking Back" in *RC Video Magazine*. For more information, contact RC Video Magazine, P.O. Box 98, Lafayette, CO 80026.

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News,** or guarantee of performance by **Model Airplane News.** When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News.**

PAT. MATTERS

(Continued from page 46)

- Three horizontal rolls; exit box.
- Enter box to double-stall turn.
- Single humpty-bump.
- Straight inverted flight; exit from box.
- Landing.

This isn't a bad little schedule, and one that's well within the capabilities of the average sportsman pilot in AMA. This contest was actually held on October 17 and 18 of 1987, but I have no results from it. It shows that there are those who know how pattern pilots must progress in order to be prepared for world class competitions. The Team Race R/C Club claims to be the first club in the "deep" South to hold an *all* turn-around-style contest, and in fact, was probably the first in the country. I tip my hat to Rick and to the TR R/C Club and hope that they carry on with their activities for the future of pattern.

Things are looking up for the flying season. New planes and equipment are always coming our way, and we'll bring you the details as we receive them. Coming up is an interesting test report on an ARF sport-pattern bird from Lanier RC*. It's called the "Caprice," and it should be an interesting subject. We also have the GM Precision Products* Rainbow Runner for the .40-size crowd, and a close-up look at a custom-made pattern bird from Taiwan, which is imported by Ten-Plus Company of Los Angeles. All this, and more, coming your way in the near future. Till then, we're on the pipe and hitting the contest trail.

**Here are the addresses of the companies mentioned in this article:*

Lanier RC, P.O. Box 458, Oakwood Rd., Oakwood, GA 30566.

GM Precision Products Inc., 510 E. Arrow Hwy., San Dinas, CA 91773. ■

CITABRIA

(Continued from page 51)

spar, use a small triangle to ensure that all ribs are vertical.

Another job that I found a little hard to control was setting up the dihedral between the center section and the outer wing panels. Trying to hold 2½ degrees on balsa wood and making a dihedral gauge of scrap balsa is impractical. I suggest that you convert the 2½ degrees to a dimension (measuring from the building board to the center of the wing tip) and then block the wing at that angle before gluing. I did it this way and it worked. I offer a suggestion here to Maxey Hester about the construction of the wing. This wing has seven spars: two on the leading edge (3/16x5/8 inch and 1/4x3/8 inch), two 1/4-inch square spars (top and bottom), two internal spars (front, 1/4x3/4 inch; rear, 1/4x3/8 inch) and a 1/8x3/8-inch

trailing-edge spar plus a sheeted trailing edge. The leading edge is sheeted top and bottom. If the top and bottom ¼-inch spars were tied together with vertical grain webs, with the leading edge sheeted top and bottom, we'd have a "D" tube, which is an extremely strong beam. Also, if we used pre-cut plywood for dihedral braces to join the center section and outer wing panels and use some high-tech carbon-fiber material like that found in the jet model designs, I think a much lighter and stronger wing could be built.

• Fuselage. This is a straightforward type of construction and is well described in the manual. If I were to build another Citabria, I would put weight-reducing holes in the ⅛-inch fuselage sides, as my airplane came in at 8¼ pounds. The fuselage was covered with Carl Goldberg's* Ultracote, and the only things that were painted were the cowl and the wheel pants. My flying buddy's Citabria was covered with silk-spun Coverite* and painted, and his weighed in at 8½ pounds. We both had the same size engine and R/C system.

• Cowl and wheel pants. I've always shied away from using wheel pants on model airplanes. They always seem to come loose and droop. Well, on *this* model, Sig has come up with a simple way of improving this by using a plywood plate with two blind nuts. This assembly is glued to the inside of the wheel pants. The wheel pants are then attached to the landing gear with two 4-40 screws that go through two clearance holes in the landing gear and then screw into the two blind nuts. An elongated slot is cut into the plywood plate and the wheel pants, and this allows the wheel pants to slide over the tire and the axle. It's a really efficient installation.

The cowl went together really easily. I installed the optional air scoop, which was used on the later model Citabrias and Decathlons. It also went on easily using very little filler putty to fill low spots. The wheel pants and cowl are made out of a tough plastic material that was very easy to work with. Make sure you coat the fire-wall bulkhead engine-block extension with fuelproof clear dope or paint. I gave mine three good coats to seal everything.

• Wing struts. Wing struts were easy to make, and they also attached easily to the fuselage. Don't leave them off the airplane, as they sure take away that model-airplane look. When you make a low fly-by or are coming in for a landing, you get the feeling you're watching a real airplane.

• Power plant. I used the O.S.* FS-61, 4-stroke engine. This is a super-running engine and was very easy to break in. I used a Zinger* 12-5 wood prop. The engine and prop made a great combination for the Citabria.

• Finishing. I didn't paint my Citabria; I covered it with Ultracote. I used this material because it doesn't have the plastic look. When the airplane was finished, it looked as if it had a factory paint job. This was the first time I'd used Ultracote; it was very easy to work, and I highly recommend it.

Painting the ABS plastic cowl and wheel pants was a piece of cake. Sand off all the gloss surface before painting, using only 220-grit sandpaper, or a finer one.

I primed my plastic parts with a light gray lacquer-base surface primer (four coats). I sanded with 400 grit (two coats) and wet-sanded the last two coats. I painted the cowl and wheel pants with Coverite's Black Baron epoxy fuelproof paint. It looks great! I was delighted with the close match between the paint and the Ultracote.

• Radio installation. I installed my 7-channel Futaba* exactly as shown in the Sig manual. There's plenty of room for everything. Follow the photos and text, and you'll be in good shape. Note the receiver and battery installation (page 21 of Sig manual). These can be moved fore or aft to help balance the aircraft.

• Windows and windshield. I changed the side windows slightly. I made a recessed frame or bezel on the inside of the windows, and I then cut the windows out of the plastic sheet and cemented them to the frame. It worked out well and looked very realistic.

I wish kit manufacturers would vacuum-form windshields as it would save a lot of time. I made a Mylar template traced off the pattern on page 24. I used this for all my cutting and trimming, and I had to do a lot of this to fit the windshield. However, it was worth it, as it came out right.

PERFORMANCE: I called Stu Richmond, my flying buddy, and asked if he would take some flight shots of my new plane. He agreed, and we met at our flying field. Our field has a minor problem: our runway runs north to south, and the wind is either from the east or the west 90 percent of the time, thus creating a problem of crosswind. This day was no exception; there was a 10- to 15mph breeze. To say that the first flight was unexciting would be an understatement. This wasn't the airplane's fault, but mine. Earlier, I said that the balance point was important. The plans show the balance point between 25 percent and 27 percent of the chord. Don't deviate from what the designer calls for. I *did* and it caused me some grief. Add to this a slight warp in the right wing panel (about 1½ degrees). I balanced the airplane at about 33 percent, just like any other constant-chord airplane. Result?—A tail-heavy airplane with a slightly warped wing!

The first three flights were disappoint-

ing. Stu finished taking the pictures, and I went home a little depressed. I called Rich Uravitch, a long-time friend, master model-builder and editor of this magazine. He told me he'd flown the Citabria and that it flew rather well. He said, however, that it should be flown with coordinated controls (rudder and ailerons). I told him I did this and it helped a little. He then mentioned that something had to be out of line. I went to my shop, took my Robart incidence meter, checked all flying surfaces and, sure enough, I found the 1½-degree warp in the right wing panel. I also re-checked the balance point and took out the lead that I'd added.

The next day, I went to the field. It was a really nice day with a slight wind blowing straight down the runway. I unpacked my van, set up my field box and fueled the Citabria. There were quite a few people at the field, and some who'd been at the first flight asked me if I was going to try again. The Citabria and I were *ready!* Before starting the engine, I made some adjustments to my transmitter, set my radio for coupled rudder and aileron, set the rudder on dual rate and the ailerons on full rate, turned on my receiver and transmitter, and made sure all of the servos were working properly. Satisfied that the R/C system was working, I started the engine, made a slight adjustment and taxied the Citabria down to the runway. I turned the plane into the wind, advanced to full throttle and was off the ground in a few feet. With a 10-ounce fuel tank, I flew for 10 to 12 minutes, then ran out of fuel and made a good dead-stick landing. As I rolled to a stop, one of my flying buddies asked me what I did to make my plane fly so much better than it had the day before. I told him I'd re-balanced the airplane and taken out the warp in the panel. All's well that ends well? I refueled a few more times and spent the afternoon flying a very pretty airplane.

**Here are the addresses of the companies mentioned in this article:*

Sig Manufacturing Co., Inc., 401-7 South Front St., Montezuma, IA 50171.

Carl Goldberg Models, 4734 West Chicago Ave., Chicago, IL 60651.

Coverite, 420 Babylon Rd., Horsham, PA 19044.

O.S. Engines Mfg. Co. Ltd.; distributed by Great Planes Model Distributors, P.O. Box 4021, 1608 Interstate Dr., Champaign, IL 61820.

Zinger; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.

Robart, P.O. Box 1247, St. Charles, IL 60174.

Futaba Corp. of America, 555 W. Victoria St., Compton, CA 90220. ■

U.S. AERO TEAM

(Continued from page 60)

this contest. No one wins by accident or default. The winner of such an event fights and maneuvers through a series of familiar and unfamiliar events before having the chance to take the trophy.

The Unlimited Competition requires each pilot to fly in four difficult events. The first is the "Known Compulsory"—a set of demanding maneuvers, known well in advance, that must be done correctly, in order and within the aforementioned boundaries. The sequences are depicted graphically via sport aerobatic's own type of hieroglyphics (otherwise known as the Aresti system), a series of figures, symbols and numbers that accurately and easily depict the conduct of each maneuver. Although difficult to understand at first glance, comprehension reveals this simple but ingenious system to be absolutely indispensable to modern aerobatics.

The second event is the "Free Program"—a series of pilot-chosen, contest-approved maneuvers that must be submitted to the judges in advance and followed carefully. A third contest requires the pilot to fly an "Unknown Program"—a series of maneuvers given to pilots just hours before the actual flight. These maneuvers must, of course, be flown precisely, and they carry the added mental burden of not having been practiced.

The final and most exciting event is the "Four-Minute Free Program"—a thrilling event designed by each of the pilots to show off their skills, ingenuity and daring. The Four-Minute Freestyle is judged as an entire event (rather than by each maneuver) since the judges have no idea what they'll see. While some rules are still in effect, the pilots aren't required to stick to approved maneuvers and may invent their own. The Four-Minute Free has been responsible for a host of new maneuvers, e.g., Charlie Hillard's "Torque Roll." The Four-Minute must be accomplished in precisely four minutes. Points are subtracted for going over this limit and leaving too early. Though a very difficult event to judge, this is a favorite of many pilots and a pivotal event in any national competition.

This year's event had its share of innovations, most notably by pilot Ray Williams flying a heavily modified S-2 Pitts with retractable landing gear! Ray did an unusual maneuver that involved a vertical climb followed by what appeared to be a hammerhead entry: When facing 180 degrees in the opposite direction (toward the ground), Ray continued the turn and circumscribed a perfect 360-degree revolution, on his side, and not once, but twice. We're talking chills up the spine, folks! It was a thrill to watch, and the hoots and yells of his competitors showed their approval of his ingenuity, skill and imagination.

For the purposes of US National Aerobatic Team selection, a second Unknown Program is flown following the completion of the normal Unlimited Program

U.S. AERO TEAM

(which serves to name the US Champion). Flown only by those who wish to make the US Team, this second Unknown program is a real bear—especially after a hard week of intense competition, heat, pressure and four other challenging flights. Even the 1986-87 US Aerobatic Champion, Clint McHenry, showed that *he* felt the incredible pressure by "zeroing" a tail slide (having recovered in the wrong direction) during this program (but not enough to seriously hurt his scores). Given the immense talent of this two-time National Champ, you can imagine the considerable pressure that he must have felt. Worst of all, were the good-natured ribbings and chuckles (especially from all those who had done the same) that Clint McHenry had to deal with! These alone would be sufficient cause to double up on practice sessions.

By the end of the week, it was clear that this year's competition was the toughest ever. The assembled pilots flew some of the best programs of their lives. The precision of some of the especially intricate, compound maneuvers was a joy to behold.

Equally fascinating were the many variations on a theme among the aerobatic planes present. While the biplane continues to be a favorite, the re-emerging monoplane configuration is proving to be a very competitive bird. The thinner profile of the monoplane is reported to be far easier to judge, and some of the newer birds, like the Extra 230, have proven to be very agile performers that handle well on relatively modest power. Still, the biplane configuration retains its proponents, though many of the Pitts-based airframes were so extensively modified that Curtis Pitts would hardly recognize them at first glance. Chief among those mods were the installation of bigger engines, highly modified wings and even one retractable gear!

With innovations like composite surfaces, new aerodynamic enhancements, engine mods, special props and many rumored "secrets," it's obvious that such a group represents the leading edge of aerobatic technology. And it's not over. There was talk of new all-graphite/carbon wings, special ailerons, new airfoils, titanium fuselages, radical new engines—you name it! The sky is hardly the limit!

Throughout the competition, it was way too easy to be impressed only by the technicalities of competition aerobatics... until you'd had enough time to get to know the people. Tom Jones and his constant supply of jokes; Paul Wenz's humorous attempt to get the team to change to the color green for official uniforms (a noble but fruitless effort); Clint McHenry's friendly banter (always willing to help a fellow pilot); Lynne Geringer's quiet intensity just before each flight; Henry Haigh's outstanding technical knowledge and his willingness to share it; Ellen Dean's shy, serious demeanor; Kermit Weeks' awareness of everything—from the latest stats to the tiniest tech detail; Patty Wagstaff's cheerful smile and hunger to talk technique... and there are so many others. The best way to understand this group is to note the groups of them, together, underneath the wings ... talking, critiquing and examining every flight with friendly objectivity, lots of smiles and a total lack of derision.

At other times, the pilots are seen standing alone on the apron with hands

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U.S. AERO TEAM

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flying imaginary maneuvers in the air, looking carefully at their diagrammed sequence, deep in concentration. No one bothers them during this; this is a time for concentration, and mutual respect dictates that they not be approached until finished with their mental deliberations. The rest of the time, there's lots of camaraderie interspersed with flying talk and the ever-present but truly honest critiques.

This year's team was announced at a packed dinner on the Friday following the competition. US Aerobatic Foundation President Bob Wagstaff and IAC President Mike Heuer had the pleasure of announcing and then introducing the team after first congratulating the winners in IAC's Sportsman, Intermediate, and Advanced classes.

Among those honored were officials from the Shell Oil Company (for their generous multi-thousand-dollar donation) and the US Air Force (which transported all the US team's airplanes to Europe last year in a C-5 Galaxy in exchange for a little gas money—$59,000 worth—thirsty devils, those C-5s). Fielding a world-class team requires a lot of help from a wide variety of sources.

The new US Aerobatic team consists of Julie Pfile of Albuquerque, NM; Alan Bush of Miami, FL; Clint McHenry of Boca Raton, FL; Harold Chappel of Ortonville, MI; Henry Haigh of Howell, MI; Kermit Weeks of Miami, FL; Tom Jones of Oklahoma City, OK; Lynne Geringer of Selma, CA; Deborah Rihn of Laporte, TX; Ellen Dean of Jacksonville, FL; Linda Meyers of Miami, FL; and Patty Wagstaff of Anchorage, AK. The best!

This summer, they'll be getting together for the first of several team training sessions prior to the 1988 World Aerobatic Championships, scheduled for August in Red Deer, Alberta, Canada. Team Manager, Paul Wenz, and the rest of the considerable USAF support staff (doctors, mechanics, judges, treasurer, video people, official delegates, trainers, etc.) will be working closely with them to help whip these pilots into the kind of team that can take on an entire world of the best aerobatic pilots and win.

The US Team has an outstanding record of individual and team victories to its credit, but it's quite obvious from this year's team members and their many support personnel, that they'll be satisfied with nothing less than overwhelming victory. The United States is known as a land of freedom and excellence; these pilots will be out to prove both.

When the team heads to Red Deer, they go with the full support and organization of the US Aerobatic Foundation. USAF is the official organization that handles the team's fund raising and disposition. Each year it has to raise a huge sum of money so that the US Team can compete with the many private and government-supported teams from around the world.

The increasing demands of world competition have made fielding a team a very expensive proposition. This is an entirely private enterprise. (Remember, they even paid for the gas on last year's C-5 ferry flight.) The support and funding of the US Team falls mostly upon the general aviation community. Each year, hundreds and thousands of pilots donate to the Foundation so that our national honor and prestige will be represented in the skies of the world. The US Aerobatic Foundation urges you to consider supporting its efforts, so that the skills and talents of our pilots will be known throughout the world. They'll be flying for all of us.

For more information, please contact the US Aerobatic Foundation, Box 3086, Oshkosh, WI 54903.

TUCANO

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when I took it to the field for the first time.

PERFORMANCE: The Tucano's flight characteristics are acceptable; it performs most aerobatics very well. It's a little faster than I expected and a *lot* faster than *some* jets, one of which I blew by as if it was practicing for a hovering tournament!

The only thing the Tucano doesn't do well is sustained knife-edge flight, but I never *did* get much enjoyment by flying around like that, anyway. The glide ratio of this ship in the dead-stick mode approaches that of a '57 Buick, so if you experience an engine failure or simply run out of fuel because you're enjoying yourself, don't try to stretch the glide... you'll only get what it wants to give you and not a foot more!

Many of us will spend $200 on a ready-to-fly airplane this year. I think that spending an extra $75 to own a Tucano may be worth it. As long as you're willing to perform the few simple mods I suggested, I think this is a difficult subject to beat—unless you wait for the new .60-size Tucano in military colors that should be in the country in about six months. In any event, Air Champ Models is having no trouble living up to its name.

**Here are the addresses of the companies mentioned in this article:*

Air Champ Models Inc., 2854 NW 79th Ave., Miami, FL 33122.

Futaba Corp. of America, 555 W. Victoria St., Compton, CA 90220.

Aerotrend, 31 Nichols St., Ansonia, CT 06401.

JET BLAST

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landing perfection and a bonus for spot-landing.

This event was won by Ron Gilman, who took home the Top Gun Award. He had the shortest takeoff (40 feet), completed ten vertical rolls and scored top points in maneuvers with a winning recorded speed of 165.66mph and a low speed of 48.70mph. He took top Static points for appearance and workmanship, scored well for perfect landing and even took the bonus points for spot-landing. That's what it takes to be Top Gun!

So there you are guys and gals; a new event for ducted-fan model fly-ins. If any of you jet model fliers would like to contribute ideas to make this a better, more enjoyable event, please contact me. If you'd like a detailed description of *all* the events, send for the December '87 issue (Volume 7) of Bob Violett's newsletter; it's loaded with ducted-fan information.

**Here are the addresses of the companies mentioned in this article:*

Bob Violett Models, 1373 Citrus Rd., Winter Springs, FL 32708.

Byron Originals, P.O. Box 279, Ida Grove, IA 51445.

Jet Hangar Hobbies, 121308 Carson St., Hawaiian Gardens, CA 90716.

Jet Model Products, 304 Silvertop, Raymore, MO 64083.

Midwest Products Co., Inc., 400 S. Indiana St., P.O. 564, Hobart, IN 46342.

Yellow Aircraft and Hobby Supplies, Ltd., Suite 201, 3040 Palston Rd., Mississauga, Ontario, Canada L4Y Z26.

Wally Zober, P.O. Box 2415 Apopka, FL 32703 ■

GOLDEN AGE

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The transmitter RF signal would have been on either the 27MHz or the 50- to 54MHz bands. The single control stick had "right" and "left" for ailerons, "up" and "down" for elevator and a steering knob for rudder. The stick controlled separate "pulsers" for each control; each pulser was associated with a particular audio tone. Thus, the transmitter provided three channels of pulsed, coded information. The fourth trimmable channel was activated by stopping the pulsing of the rudder-channel tone. This was done with a separate switch that could momentarily cut the rudder-channel pulser out of the circuit. As you can imagine, the need for

NAME THE PLANE CONTEST

Can you identify this aircraft?

If so, send your answer to **Model Airplane News,** Name the Plane Contest (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Warren Eckhart of Peoria, IL, for correctly identifying the Junkers G-38 transport in our April issue. Warren's name was chosen from the 62 correct answers submitted! We didn't think it would be *quite* that easy!

The Junkers G-38, built in 1929, was designed and manufactured as a means of economical and dependable air transportation. The span of this behemoth was 144 feet, and it had a wing area of 3,121 square feet! Empty weight was 28,660 pounds with a max flying weight of 52,900 pounds. It "boasted" a top speed of 121mph with a range of 2,175NM. It required a crew of six, some perhaps comforting the 34 passengers—especially the six who were seated in the leading edge of the wing behind glass windows! Two Junkers G-38s were produced: one was "lost" in a takeoff accident; the other (pictured) "acquired" by the Luftwaffe and christened "General Field Marshal von Hindenberg." It did *not* survive the war!

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to Model Airplane News. If already a subscriber, the winner will receive a free one-year extension of his subscription.

GOLDEN AGE

several tone generators and an equal number of pulsers made for a complex transmitter.

In the receiver, tone filters complementary to the transmitter coding routed the incoming information to the proper servos in the form of pulsing voltage. With three separate information channels, any interaction was virtually eliminated. Within the rudder channel, after the filter, a pulse omission detector was also included to allow operation of the fourth trimmable control.

On his Model 21, Don Brown replaced the scissor-style neutralizing spring in the Bellamatic servo with a much simpler one. This design change reputedly made the Bellamatic much more linear in action. Also, the Bellamatic's high gear ratio effectively absorbed the pulsing, so that very little was apparent at the control surface.

Although this was basically a pulse system, this configuration did produce a true multi-channel proportional system too. For the first time, there were *separate* propo channels for the three primary controls. For whatever reason, the Model 21 wasn't widely distributed, but those who *did* use them reported very favorable results.

The most popular Dee Bee system could have been a refinement of Model 21. With this Quadraplex, a fourth audio channel was added, so that the engine became independent of the rudder channel.

I have a nice photo of genial Bill Northrop and his "Foo-Too" model. Bill is from the Delaware area, and was very active in early R/C with the DC/RC group. The Foo-Too was a special model built for attempts at world records in contests of distance and duration, etc. The Russians held all the records, and there was an AMA movement to do something about it! The Foo-Too was powered by a Fox .59, had an area of 1,000 square inches, and weighed only 5 pounds, 9 ounces dry. R/C was by Quadraplex. At the Dahlgren Navy base, Bill broke the Russian altitude record by flying to about 16,000 feet. This is only one of the early attempts on records, and I'll tell you about others when space permits.

If you're searching for OT R/C plans, Alan Walker tells us that England has competitions for OT R/C aerobatic flying, and that they have some OT pattern-type model plans available. Interested? Want more info? Write to Alan Walker, 5 Farm Close, Belper, Derby DE5 1RY, England, U.K.

From here, it's on to more proportional history and any old-time activities you wish to pass along. Have you checked your receiver range lately? A daily "must do" not too many years ago!

P.S. I hope you digested the "Old-Time R/C Activities" presentation in the April '88 issue. My objective was to make you aware that many OT R/C fliers, and others, too, think the activity needs an organization. As I write this, the idea is new, but I've already had phone calls and letters of support. A couple of people expressed the desire to be member No. 1! An OT R/C organization is possible. Will someone act as a moderator for the initial organizing? I'm waiting to hear from you!

Club of the Month

Edmonton R/C Society

The Edmonton Radio Control Society from Edmonton, Canada, is the *Model Airplane News* "Club of the Month" for June 1988.

The ERCS has a schedule of events that includes two pylon-racing meets and a scale meet, to be held on their home turf, and an auction, static display, air show, fun-fly and world aerobatics, to be hosted by other area clubs. According to the club newsletter, the "ERCS News," the calendar is starting to fill up, and, although it may be taken for granted, this busy schedule is a testament to the determination of the club's governing board to provide the members with more than a site to fly at. Their dedication promotes not only the ERCS, but model aviation as a whole.

The "ERCS News" also shows the club's commitment to existing members, as well as to younger and prospective members. The newsletter isn't cluttered with long-winded notes of previous meetings or unfortunate crashes. There's a place for this information in a newsletter, but it shouldn't make up the entire content. The "ERCS News" contains information on club happenings, rules, etc., but also important is the technical information, which educates both the novice and the seasoned flier. To keep R/C flying alive and well for years to come, the ERCS has instituted a Youth Program to "introduce the hobby of model-airplane flying to the youth of our community." The program, which is being headed by Mo Alam, isn't restricted to R/C; it's "roots"-oriented and will include such subjects as free-flight and aerodynamics.

Other sections of the "ERCS News" include safety tips on storing CA glues, tips on noise control to meet the upcoming 95dB limit and other helpful information. One of the most informative pieces we've ever seen in a newsletter is an article by Mo Alam called "An Insight Into Pulse-Code Technology," where Mo explains the function and advantages of a PCM-type radio system.

It's people like Mo Alam and the rest of his club who will keep model-airplane flying popular for generations to come. This is why *Model Airplane News* is pleased to award the Edmonton Radio Control Society two free, one-year subscriptions, which they can give to a couple of the club's outstanding junior members. ■

Each month Model Airplane News will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). Model Airplane News will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletter to Model Airplane News, Club of the Month Contest, 251 Danbury Rd., Wilton, CT 06897.

AEROBATICS

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to create a single, flowing, aerobatic flight for the pilot.

The plane is first flown to the show center at a relatively high altitude to set up for the two-turn spin. You'd come into the show center heading upwind, throttle back and allow the ship to stall from level flight right into a spin. To do the spin, just feed in all the right rudder, right aileron and up-elevator you can get to the transmitter. If a wing stalls, the ship will spin. Do only two rotations, and then allow the spin to stop. You should be aiming in the same direction as the entry, but heading straight down. Ease out and throttle up to the next maneuver, which is a hammerhead.

"Hammerhead" is just another name for a stall turn. In this case, the hammerhead will be used to return the ship to show center. As described earlier, pull to vertical throttle back, hit hard rudder and pivot 180 degrees to straight-down vertical. Ease out and throttle up; you're on your way towards show center again for the half-reverse Cuban 8. This will be done after the plane passes show center to the other side of you, and it begins with a climb up at 45 degrees. Now you roll over to inverted and perform a graceful 270-degree loop to level flight, heading back to show center. At show center, you do an easy inside loop. Do this with grace and ease, pulling out straight and level and heading upwind to the next turning maneuver, a half Cuban 8.

The half Cuban 8 is just like the half-reverse Cuban 8, but the looping comes before the half-roll. From level flight, pull the ship up into a nice loop and halt the loop when the nose of the ship reaches an angle of 45 degrees to the horizon on the downward side. Now roll over to upright, and, heading for show center, pull the ship back to straight and level flight.

So far, we've used loops, rolls, stalls and spins for the maneuvers. The next maneuver, an Immelmann turn, continues this progression. Created by a combat pilot in World War I, this evasive-action maneuver is quite easy. Fly past show center to the other side of the field for this. From straight and level, pull the ship up into half a loop. At the top of the loop, roll the ship from inverted to upright, and that's it; a half-loop with a half-roll.

Now head back to show center for a snap roll. At speed, the snap roll uses the same control inputs as the spin, but approaches from straight and level at full speed. Quickly hit the controls hard, and watch out! The ship will snap over so quickly that it may be hard to stop it at straight and level again. You may need reduced power settings to perform this one, but when you do it, you'll know why they call it the snap roll. We are quite high in the sky right now, and heading to the edge of the field. To bring us down and return us to show center, the split "S" is next.

This maneuver is the "mirror" opposite of the Immelmann turn. You remember that the Immelmann was a half-loop with a half-roll? Well, the split "S" is a half-roll followed by a half-loop to straight and level flight. This is done at reduced power

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AEROBATICS

settings to prevent over-stressing the plane. You're heading for show center, and the classic barrel roll is next.

The barrel roll is simply a non-axial roll, and an axial roll is one that sees the aircraft roll perfectly about the center line of the ship. A barrel roll rotates *around* the center line. On some planes, it can be done with rudder input. Simply put, it's a rather sloppy-looking roll, but one requiring close attention to do correctly.

We're heading to the edge of the field again, and here we hit the Humpty Bump. From straight and level, pull the ship straight up to vertical, and as the speed bleeds off, push the stick forward to do one half of an outside loop. The ship is now headed downward, and the book tells you to roll one half-roll. No sweat; you'll pull out coming back to show center.

The two-point roll is next; this is a straight leg of inverted flight. It sounds very easy, but holding straight inverted flight for a mere three seconds can be pure agony if you're not ready for it. When you make it, roll back to upright for another Humpty Bump (this one with the half-roll on the way up, instead of the way down). The result is the same; you're going to return to show center in the upright position.

The last maneuver is a slow roll. This is simply a roll that takes at least three seconds to completely perform. Use your acquired expertise, and you can feed in rudder to hold the nose as the ship rolls past the first 90 degrees. Rolling to inverted, the rudder is eased off and the down elevator is fed in. Rolling continues past inverted, and we feed in opposite rudder as the ship hits 270 degrees of roll. We slide the rudder out and come to level flight as we roll to straight and level. Whew! Was that enough for you? And how! Once you get through this sequence and are feeling confident about it, you will progress and really get to know and love aerobatics.

For many of us, aerobatics is what R/C flying is all about. There's nothing wrong with droning around the sky and admiring the miracle of flight, but, as someone out there once said, "Only those who dare, truly live."